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A PRACTICAL TREATISE

ON

TUNING AND REPAIRING

THE

PIANO-FORTE

BY

HOWARD W. PYLE

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PREFACE.

The author's aim has been to furnish a thoroughly practical book of reference for anyone who intends to become a tuner and also repairer of the Piano-Forte.

It will be found useful to musicians and owners of Pianos and Organs in general.

It will be specially useful to any who desire to become practical tuners, and who have not the facilities to learn in a factory or store, and to any who may live in remote sections and who may wish to repair or regulate their own Pianos.

Anyone who follows carefully all the directions outlined will be able to tune with precision, and quickly remedy any defects in their Pianos or Organs.

The author has given the results of twenty-five years of careful study and experience. The aim has been to give in as small space as possible the very fullest details, both in tuning and repairing. Much more might be said, but would be superfluous and confusing to the beginner.

Many systems of tuning are in use, but the author has given only the methods which by his own life time experience invariably insures the best results.

There is also given the most comprehensive account of pitch ever published.

The Author,

HOWARD W. PYLE,

Philadelphia, Pa.

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A Practical Treatise
ON
Tuning and Repairing the Piano-Forte.

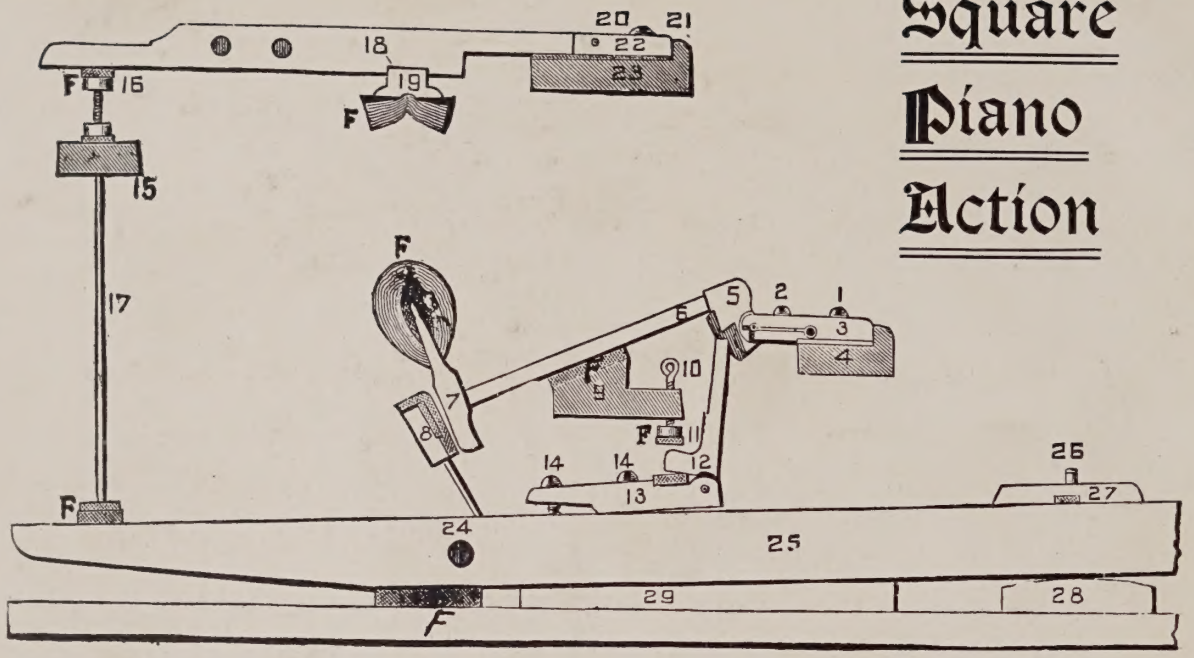
IN beginning to study the art of "Tuning and Repairing the Piano-Forte," it is stated that a person must have a correct ear for music, and also a reasonable amount of mechanical genius. Frequently musicians live in remote sections where it is difficult to procure the services of a tuner when needed. There is no reason why a person who possesses the ear and genius should not be able to tune his own piano. Some people having had the tools, and by practicing on their own piano, have been known to develop into professional tuners.

It is very necessary to have an instrument to practice upon so as to become thoroughly familiar with all the mechanism, and to practice taking apart and replacing every detail of the action. To become proficient in any art it is necessary to study carefully the work of the great masters; so in piano tuning and all its branches, proficiency is gained by carefully examining the work of the best piano makers.

It is very essential in beginning to learn the art of tuning to handle carefully all the parts of the piano-action, so as not to break or destroy any of the delicate mechanism. A tuner will thus save himself many unnecessary hours of work.

Square Piano Action

1 & 2 Hammer Flange Screws.
3 Hammer Flange.
4 Hammer Flange Rail.
5 Hammer Butt.
6 Hammer Stem.
7 Hammer.
8 Back Catch.
9 Hammer Rail.
10 Regulating Screw.
11 Regulating Button.
12 Jack.
13 Fly or Jack Rocker.
14 Fly Screws.
15 Lifter Buttons.
16 Lifter Buttons.
17 Lifter.
18 Damper Lever.
19 Damper Head.
20 Center Pin.
21 Flange Screw.
22 Damper Flange.
23 Damper Flange Rail.
24 Key Lead.
25 Key.
26 Balance Rail Pin.
27 Key Button.
28 Balance Rail.
F indicates felt covered parts.



Tools.

Always purchase the best tools. Cheap articles never give much satisfaction.

Provide the following tools:

1. Tuning hammer, star head, also oblong heads for tuning old square pianos.
2. T hammer for stringing.
3. Felt picker.
4. Screw driver (three sizes).
5. Regulating screw driver.
6. Combination awl.
7. Felt knife.
8. Tweezers.
9. Alcohol lamp.
10. Felt scissors.
11. Wire cutters.
12. Tuning wedges.
13. Tuning fork—"c"—(International pitch).
14. Wire gauge.
15. Sand files.

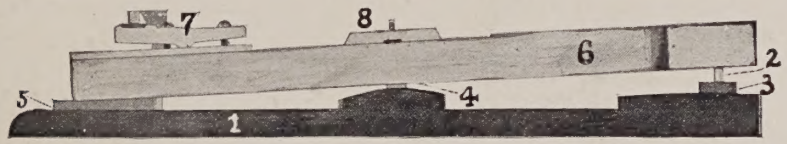
Description of the Square Piano Action.

To remove the action.

To take the action out of the square piano, first remove the thin key strip in front of the keys, which is held in place by dove-tailed grooves, fitting over the screw heads in front of the action frame. This can be forced up with the fingers. The screws holding the action are found directly under the edge of the white keys, or, as in some cases, underneath the frame of the piano. After removing the screws, pull out the wire handle, used as a hand-hold; then draw the action forward, always being careful not to press down any keys while removing the action, which would cause the hammers to raise, and thus be broken by striking against the sounding board. It is always better to place the action on a table, the top surface of which should be quite level.

Hammers—Be careful not to break in removing the action.

Key and Key Bed.



1. Key Frame or Bed.
2. Front Guide Pin.
3. Front Rail Cushion or punching.
4. Center Rail Cushion or Punching.
5. Back Rail Cloth.
6. Key.
7. Key Rocker.
8. Center Pin.

Replacing Felt on Key Rails.

Key-Rail Felts.

In the bottom of the key frame, directly under the keys, will be found three rails (front, center and back). Each of these rails have felt on them. This felt is frequently moth-eaten; sometimes it is entirely destroyed.

Felts—Use same quality in replacing.

In replacing them, be careful to use felt exactly the same thickness, and not only the same thickness, but same quality. For instance, felt one-quarter of an inch thick of very soft material will yield a much deeper touch when the key is pressed firmly, than the same thickness of very firm felt

Punchings.

The front and center rail punchings can be purchased of any desired thickness and quality from dealers. It is always better to send samples of the old felt to insure the new being the same.

Back-rail Felt.

The back-rail strip of felt, if necessary, should be taken off and replaced. Cut the new strip exactly the same as the old, and glue only the one edge. The edge upon which the keys strike should not be glued at all, as it will often cause the felt to be so hard as to produce a knocking noise as the key falls on it in playing.

Depth of Touch.

Depth of Touch.

The modern depth of touch is three-eighths of an inch, and this means three-eighths at the center of the ivory head, or about where the thumb would strike the white key in playing. It is better to use a rule or gauge divided into thirty-seconds of an inch.

Key—How to strike to get proper depth of touch.

In pressing a key to get the proper depth of touch, bear in mind not to press harder than you would in ordinary playing. For instance, a key may show a three-eighths' depth of touch under ordinary striking of the key, but, by pressing very hard and thus compressing the felt, can be made to show a deeper touch.

Depth of touch altered by changing the center rail.

The depth of touch can be altered considerably by raising or lowering the center rail. This rail is fastened to the frame by screws, and by loosening them and placing cardboard underneath, the desired depth of touch can be secured.

Shallow touch.

If the piano is a very old one, and the depth of touch very shallow, it is better not to make any attempt to alter the same, as all other parts of the action would have to be altered to correspond; and only a thoroughly experienced piano maker could do this work.

Sticking Keys.

Sticking Keys.

A key frequently sticks at the front or center pin hole. The remedy is to take the key out and, by the use of key pliers, enlarge the hole. Tuners frequently use the point of a screw driver, but it does not answer the purpose as well, the hole being made so large sometimes as to allow the front of the key to strike against the next one.

Key pin hole (how to enlarge).

Keys warp.

A key sometimes warps so as to interfere with the next one. The remedy is to plane or sandpaper the part until released.

Sometimes obstructions get between the keys. Remedy: remove the obstructions.

Key strip touches key.

When keys touch the key strip in front, remove the strip. If the key and ivories are found all right, the trouble is caused by the strip warping in toward the key. A piece of felt placed between the key frame and the strip may hold it far enough out from the keys, but if it does not, then put in screws with larger heads.

Key Leads.

If the key leads interfere with the adjoining keys, cut away the protruding lead with a penknife. If ivories interfere with each other, file off the ivory.

Jack Spring.

If the jack spring is broken or out of place, put in a new spring, or place the thread in proper position.

Key Rocker.

Key Rocker.

Attached to the key will be found a rocker, which is secured by two screws. The purpose of these screws is to raise or lower the end having the jack attached.

To replace Jack or Spring Thread.

In this rocker is a spring, secured at one end with a thread. If the thread attached to the jack spring should break, bore out the plug holding it, replace the thread, draw it through the hole, and secure with a new plug, using a little glue.

Jack.

Jack—How to regulate.

The jack, if raised too high with the rocker screws, cannot properly slip into position under the hammer heel. If too low, there will be lost motion; and the key can be depressed more or less before the hammer begins to move at all. There should be just the slightest lost motion, so that by pressing the key and allowing it to come up slowly, the jack will come fully and freely under the hammer heel.

Jacks work sluggish.

Sometimes these jacks do not work freely at the flange pin, very often caused by dampness. The remedy is to place a drop of kerosene oil at the sides of the centre pin. This will release it immediately. Care should be taken not to use a superfluous amount of oil, as it, by running over the wood work, will spoil the appearance of an action.

Keys Rattle.

Keys rattle.

Keys frequently rattle at the front or center mortise, the felt having worn or fallen out altogether. Remedy: Replace the felt.

If, in a very old piano, there never was any felt at the mortise, either cut out the hole and put in felt, or wedge

each side by driving in sharp sticks and cutting off until the mortise is tight enough to stop the rattle on the guide pin.

The felt, on which the lifter wire strikes, is often worn through. Replace it with new felt or buckskin.

Key Lead loose.

Keys rattle also when the key lead is loose. Take the key out and hammer the lead until tight.

Sometimes the screws holding the jack rocker work loose. Tighten the same, being careful to leave the jack properly regulated. (See Jack.)

Regulating Screw.

Regulating Screw.

The regulating screw should be raised or lowered, so that when the key is pressed down slowly the hammer will come to within a quarter of an inch (or a trifle less) of the string before falling.

Regulating Buttons.

If the felt on the regulating buttons has worn much, especially in the center where the piano is most used, it is better to take off the regulating rail and put on a new set of felts, rather than attempt to re-regulate with the old, uneven felts. Sometimes when the whole set of regulating buttons needs to be changed very much, either raised or lowered, as the case may be, or, when the button needs to go further than the screw thread will allow, it is well to lower or raise the rail itself. This is easily done at the regulating props. A slight raising or lowering of the button will then make the regulation perfect.

Hammers Stick.

Hammers Stick.

A hammer frequently sticks at the flange, usually caused by dampness, the parts swelling so the flange pin cannot work freely. Remedy: Loosen the screw a trifle until the hammer falls readily.

Hammers strike each other.

Hammers will sometimes become flattened at the top by striking against the string, thus causing them to stick against each other. The remedy is to trim the sides off until they work freely. Never cut the top of hammers; but if necessary, use a sandpaper file to take off the ridges which have been worn in the hammer by striking the string.

Hammer Flange Screws.

If the screws holding the hammer flanges on the hammer rail become loose, the whole set of hammers will shift so as not to strike the strings correctly. In this case put the hammer in correct position and tighten the screws.

Replacing Hammers.

Replacing Hammers on Square Pianos.

To replace hammers on a square piano is a job requiring great care. First remove the old hammer by heating the glue with a flame from an alcohol lamp, made for this purpose. As soon as the glue softens, the hammer can easily be twisted off. The best way for replacing is first to take off every other hammer and place on a new one between the two old ones. This will insure the new hammer being cut exactly the same shape as the old one. Do not glue until you have several hammers ready. Be sure to get them in exact line with each other. The hammers come from the makers numbered, and care must be used to keep them in regular order.

Revoicing Old Hammers.

Revoicing old Hammers in Square Pianos.

When hammers have become much worn and it is not desired to put on a new set, the old ones can be much improved in tone by rounding them off with a sandpaper file

and picking them with felt pickers. Of course this improvement in tone is but temporary. Every time a hammer is re-pointed there is more or less loss of felt; and it is soon worn so thin as to require a new set.

Re-capping Hammers.

Re-capping Hammers.

Capping Leather—How to cut.

To cover old hammers, select the best capping leather. Cut it in strips wide enough to allow for some stretching when it is pulled over the hammer. Always cut the leather the way of the least stretch to insure the best tone. Put glue down the sides, but never on the top. After placing one end of the leather on the hammer, pull it firmly over the top, and then tie or clamp it until the glue is hard (umbrella rings can be used for this purpose); after which trim the edges off. Experience will soon insure a neat job.

Damper Action.

Damper Action.

Damper Felts—How to order.

The felts on the lifter wire and also the damper heads are frequently eaten with moths. These felts can all be purchased from action dealers, and are easily replaced. Be sure to send samples of the felt to insure the new being exactly the same.

Back Catch.

Back Catch—How to regulate.

The back catch wire should be bent so as to catch the end of the hammer heel about one-third to one-half way down on the felt cushion. This will be found to give a good repeating action.

Back Catch Felt.

If the felt on the back catch is worn off, replace it, as the hammer heel, by striking against the wood, will produce a disagreeable knocking noise.

Rattle in Square Piano.

Rattle in Square Piano.

Foreign bodies on sounding board.

The square piano rattles from many causes. One of the most common is foreign bodies dropped upon the sounding board, such as pins, tacks and other articles. Sometimes a pin will be dropped under the iron frame in such a position as to be very difficult to get out. A broken umbrella rib is often useful; or a piece of wire with a cloth tied to the end and drawn through will frequently dislodge a pin or tack. Articles about the room, such as lamps, glass-ware, pictures on the wall, clocks, or other ornaments upon the mantlepiece, and even stove doors sometimes cause a rattle. If the piano rattles badly, the quickest way to detect what is causing it is to have one person strike the offending keys while another listens carefully over the piano and around the room. The nearer you approach that which is causing the rattle, the louder it becomes to the ear. The remedy will suggest itself.

Ivories—How to Keep White.

Ivories—How to keep white.

The question is often asked, How can I prevent ivories from turning yellow? It is a difficult question to answer. The best thing to do is to keep them clean by wiping them off with a perfectly clean dampened cloth (cheese cloth is the best to use). Do this as often as necessary, especially in the summer, when the fingers perspire.

Allow the keys to have plenty of daylight; but even this will not have the desired effect unless they are kept clean.

To Whiten Ivories.

To whiten ivories.

The best way to whiten ivories is to take the keys off and sandpaper, or scrape until the yellow is removed, after which polish with whitening and alcohol. The simplest and most perfect way for polishing, after sandpapering sufficiently, is to take a block of wood, say three by eight; fasten to the top of it a piece of white felt one-half inch thick. Wet the felt through with water first; then make a paste on the top of this of whiting and alcohol, keeping the same moistened from time to time with alcohol. The block can be fastened in a vice or on a bench of any kind; then by holding the key in the hand and rubbing briskly on this, it will be found to give the ivory an excellent polish, after which dry with a clean piece of cheese cloth.

Celluloid.

Celluloid.

In case keys are covered with celluloid, it is rarely necessary to sandpaper or scrape. Wood alcohol, used on perfectly clean cheese cloth, will remove the yellow. Polish with whiting and alcohol as before. If too yellow for the alcohol alone to cut enough to whiten sufficiently, use sandpaper as in the case of ivory.

Defective Damping.

Defective Damping.

Wooden bridge loose.

Damper wire sticks in socket.

The wooden back bridge sometimes comes unglued and springs upward. The damper wires which pass through it become cramped so as not to slip back through the socket hole. Enough strings must be taken off to allow clamping and glueing the bridge in place. It is better to fasten with several screws, so as to avoid a recurrence. If a damper wire sticks in the socket hole, heat it and burn out the cloth enough to allow it to work freely. If the pins holding the damper levers in position slip out, replace them.

Hammers Block.

Hammers Block.

When the jack remains under the hammer heel. The felt on the regulating button may be worn out or displaced, or the button may be broken, or the felt or the hammer heel may be out of place. The remedy will suggest itself.

Defects in Pedal and Trap Action.

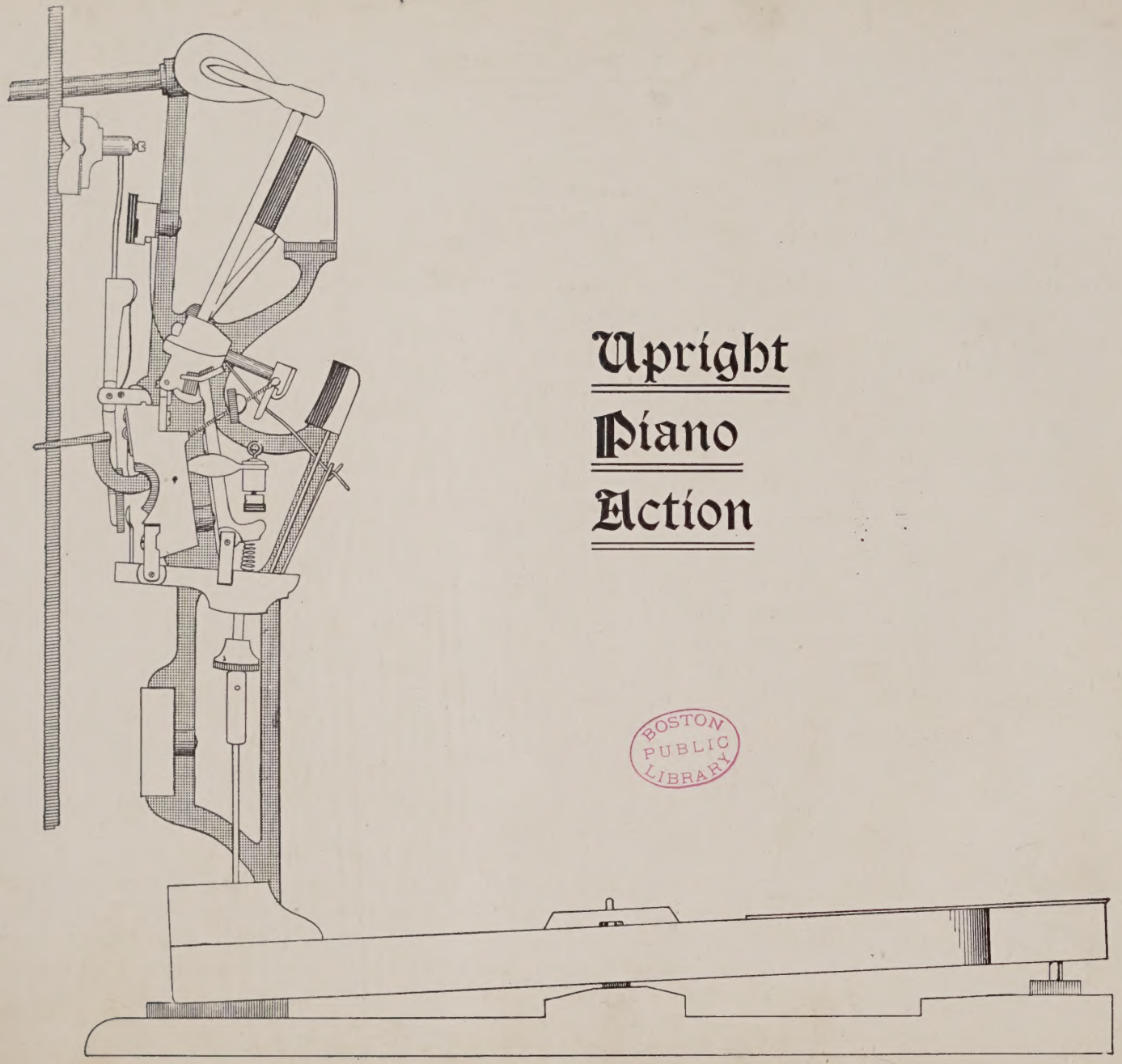
Defects in Pedal and Trap Action.

If the pedal squeaks, take out and black lead the pins. Some use brown soap. If the pedal stick is too short, renew the felts, or use thicker bushing to take up the lost motion. If the trap work, plugs, or elbows come unglued, reglue them. If the bushing is worn so as to cause a rattle in the action, replace it.

To Replace Broken Strings.

To replace broken strings.

First gauge the old string and replace it with one the same size. A string generally breaks near the tuning pin. It is not necessary to take the pin entirely out; but give it two or three turns back with the tuning hammer, then with pliers twist off the old piece of string. Push the end through the eye in the wrest pin. Turn the pin with the hammer until there is about three coils around the pin. Fit the wire around the bridge pins and also hitch pins. Allow enough wire for the wrest pin as before. After the wire is properly in place, draw it to pitch. In tuning it is better to draw one-half tone or so above the desired pitch and allow it to remain for a few minutes, then rub well with leather to take out the stretch, after which tune carefully to its octave.



Upright Piano Action

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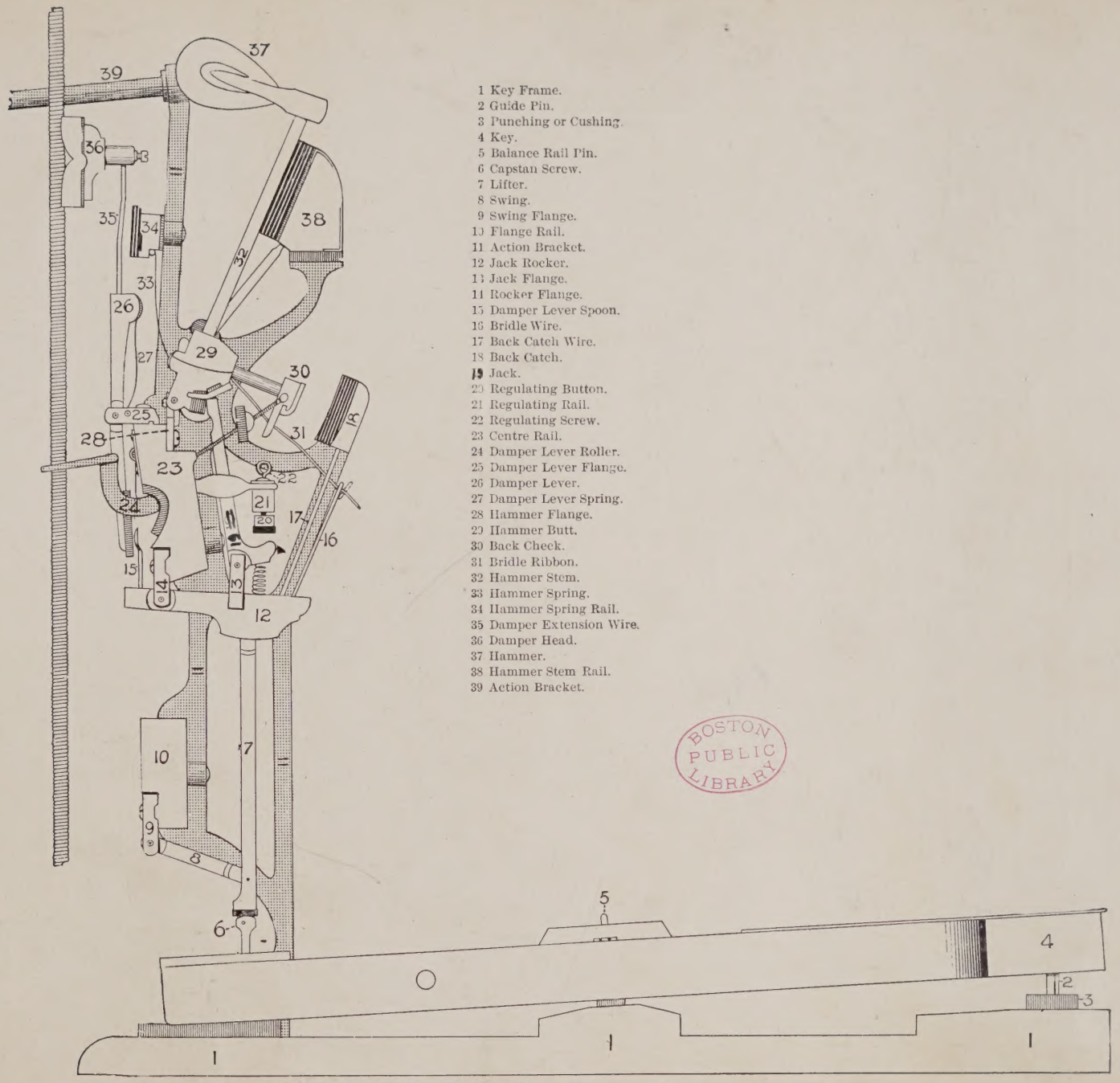

1 Key Frame.
2 Guide Pin.
3 Punching or Cushing.
4 Key.
5 Balance Rail Pin.
6 Capstan Screw.
7 Lifter.
8 Swing.
9 Swing Flange.
10 Flange Rail.
11 Action Bracket.
12 Jack Rocker.
13 Jack Flange.
14 Rocker Flange.
15 Damper Lever Spoon.
16 Bridle Wire.
17 Back Catch Wire.
18 Back Catch.
19 Jack.
20 Regulating Button.
21 Regulating Rail.
22 Regulating Screw.
23 Centre Rail.
24 Damper Lever Roller.
25 Damper Lever Flange.
26 Damper Lever.
27 Damper Lever Spring.
28 Hammer Flange.
29 Hammer Butt.
30 Back Check.
31 Bridle Ribbon.
32 Hammer Stem.
33 Hammer Spring.
34 Hammer Spring Rail.
35 Damper Extension Wire.
36 Damper Head.
37 Hammer.
38 Hammer Stem Rail.
39 Action Bracket.

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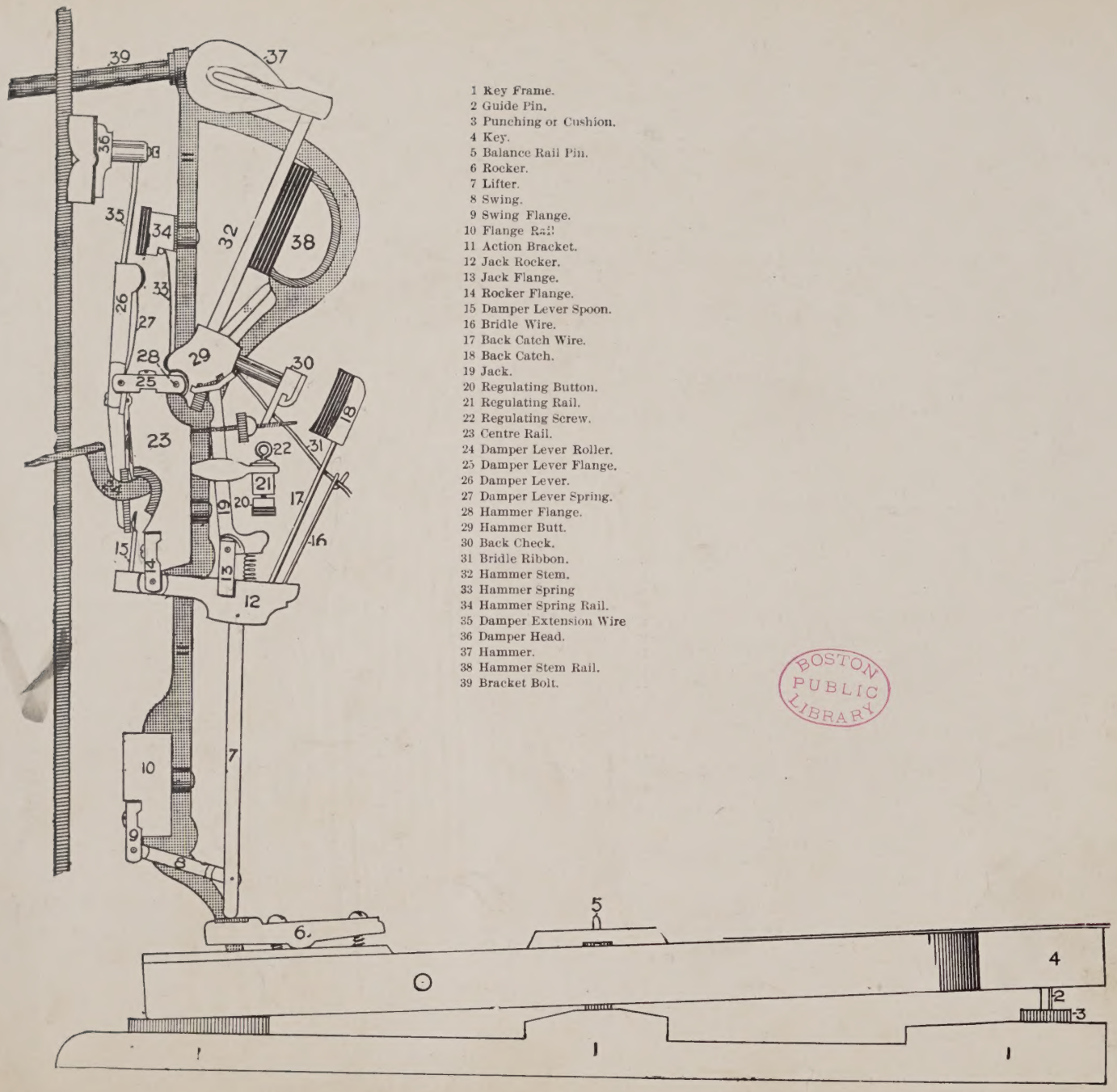

1 Key Frame.
2 Guide Pin.
3 Punching or Cushion.
4 Key.
5 Balance Rail Pin.
6 Rocker.
7 Lifter.
8 Swing.
9 Swing Flange.
10 Flange Rail.
11 Action Bracket.
12 Jack Rocker.
13 Jack Flange.
14 Rocker Flange.
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32 Hammer Stem.
33 Hammer Spring
34 Hammer Spring Rail.
35 Damper Extension Wire
36 Damper Head.
37 Hammer.
38 Hammer Stem Rail.
39 Bracket Bolt.

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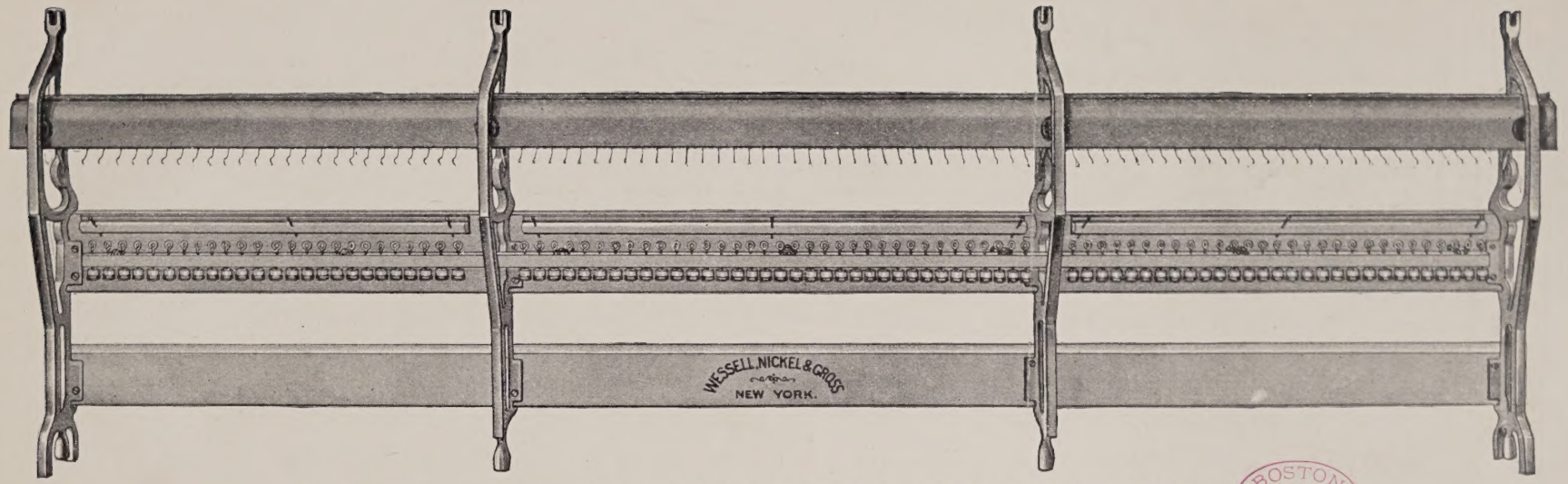

THIS DIAGRAM SHOWS THE IRON BRACKETS WITH THE RAILS IN POSITION, WITH ACTION NOT SET UP.

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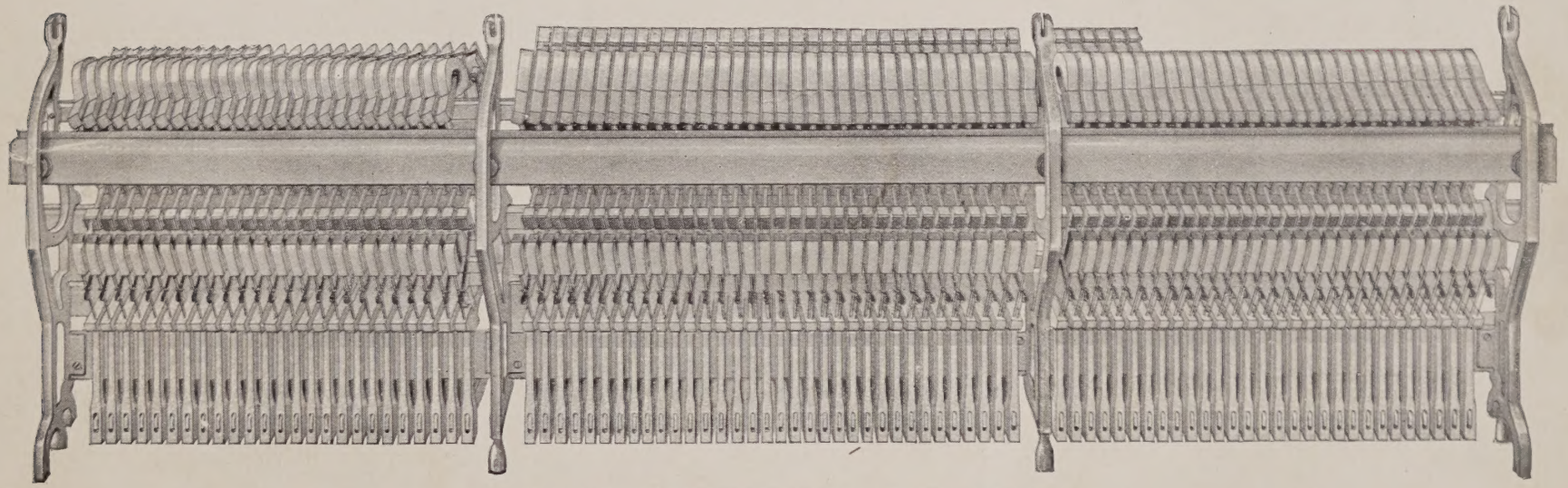


THIS DIAGRAM SHOWS THE COMPLETE UPRIGHT ACTION.

Upright Piano.

To remove action.

First remove the soft pedal stick. This is necessary in most pianos, not in all, however. Then unscrew the buttons holding the action. Tilt the action forward until released from the bolts, then lift it out. (See photo.)

In one or two makes of pianos the whole keyboard and action come out solid, and in a few pianos, especially in old makes, the bottom of the lifter is split and sets over a pin in the key rocker, and requires to be disconnected before the action is lifted out.

To Regulate Upright Action.

Sticking Keys.

Should keys stick or work sluggish, examine them at the guide pins. If necessary, make the hole in the key a trifle larger, with the key pliers, or the tapered end of a tuning fork. Use care not to make the hole too large, for it will not only be likely to rattle on the guide pin, but the keys will strike against each other. To be just right, there should be a slight movement sideways on the pin. (See "keys Stick on Square Piano.")

Guide Pin.

Guide Pin.

If the hole is too large already, and an oval guide pin is used, turn the pin a little and it will usually cause the key to work properly.

To Even Up Keys.

Keys—To even up.

This can be done with paper punchings on the centre rail. It is better to use a straight edge in the beginning at least. See that the first and last keys are properly adjusted with it. If the key bed itself has warped out of shape, it will be found easier to first level up the centre rail. Take off the keys, as it will be more convenient to alter the rail with them off. Leave two or three keys at each end, and two or three in the centre for testing. Raise or lower this rail until the proper depth of touch is secured, after which replace all the keys and proceed to even up the whole set.

To Even Up Hammers.

Hammers—To even up

See that the hammers strike the strings squarely. They can easily be adjusted by shifting slightly at the flange to the right or left. Be careful to leave the flange screws tight, as they will rattle.

Lost Motion.

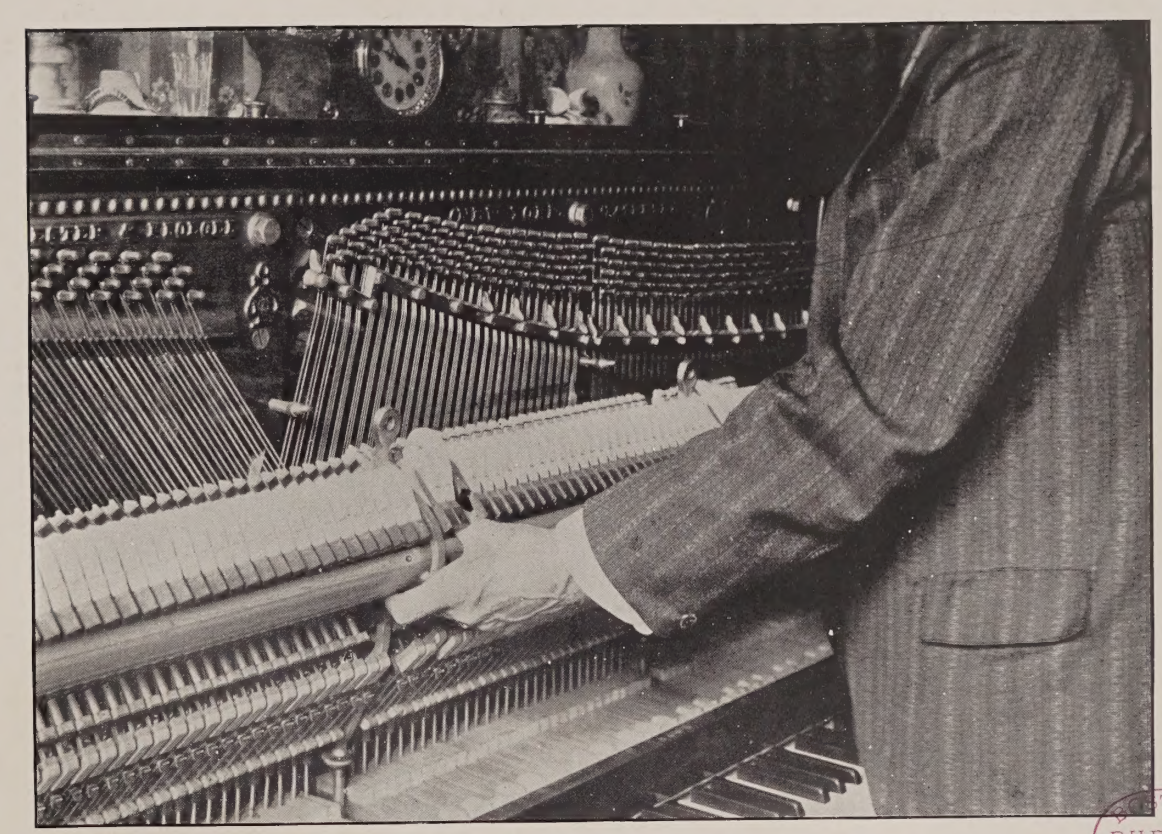
Lost Motion in Upright Pianos.

The lost motion is caused by a settling of the felts. If a rocker action is used, adjust the screws at the rocker until the jack rests firmly under the hammer butt. It is easy to discover any lost motion. If the key is pressed slowly, the jack and also the back catch will be found to move some distance before the end of the jack strikes the hammer butt; and the key will have a perceptible movement without the hammer moving at all. It is correct when the jack falls readily under the hammer heel and there is just the slightest lost motion. The end of the hammer should move almost simultaneous as the key is slightly depressed.

Lost Motion—How to discover.

If the jack is too high it will not fall in place; and if it does, it will force the hammer from the stem rail, and it will cause a bad repeating action. If a capstan screw is used, simply turn the screw with a lever to take up the lost motion.

Jacks too high.



Action released—ready to lift out.

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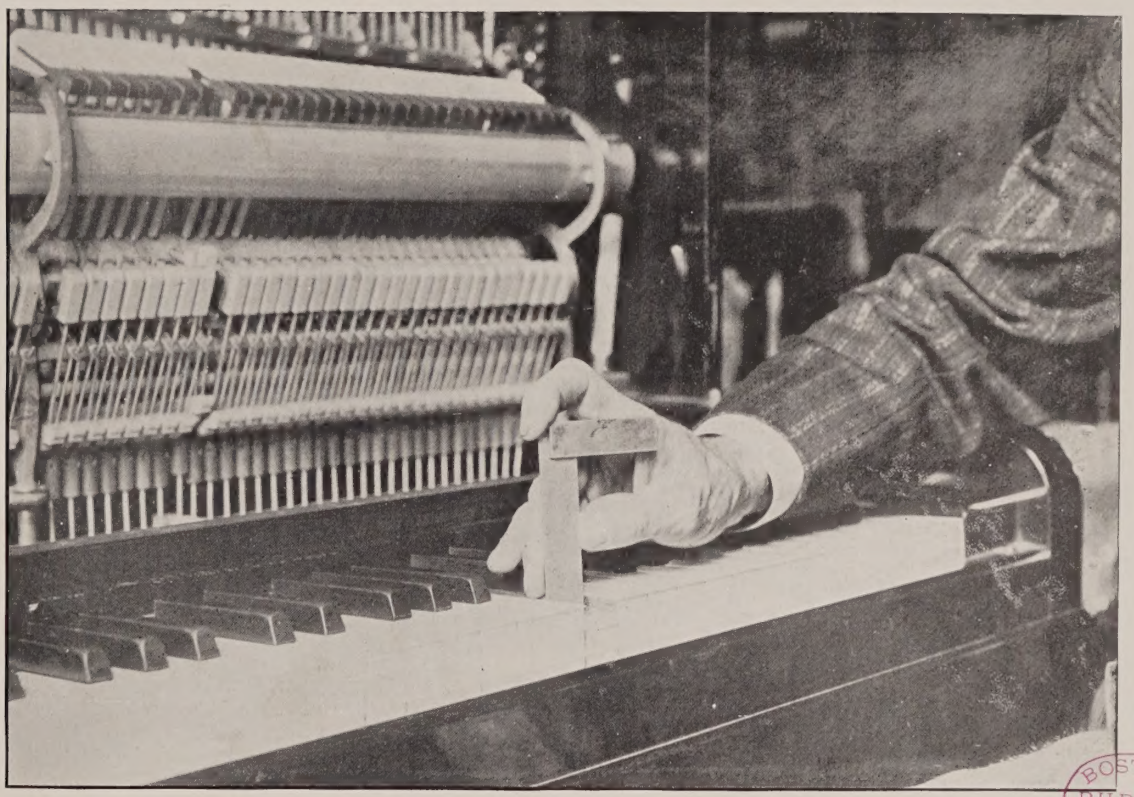

Showing how to get depth of touch.

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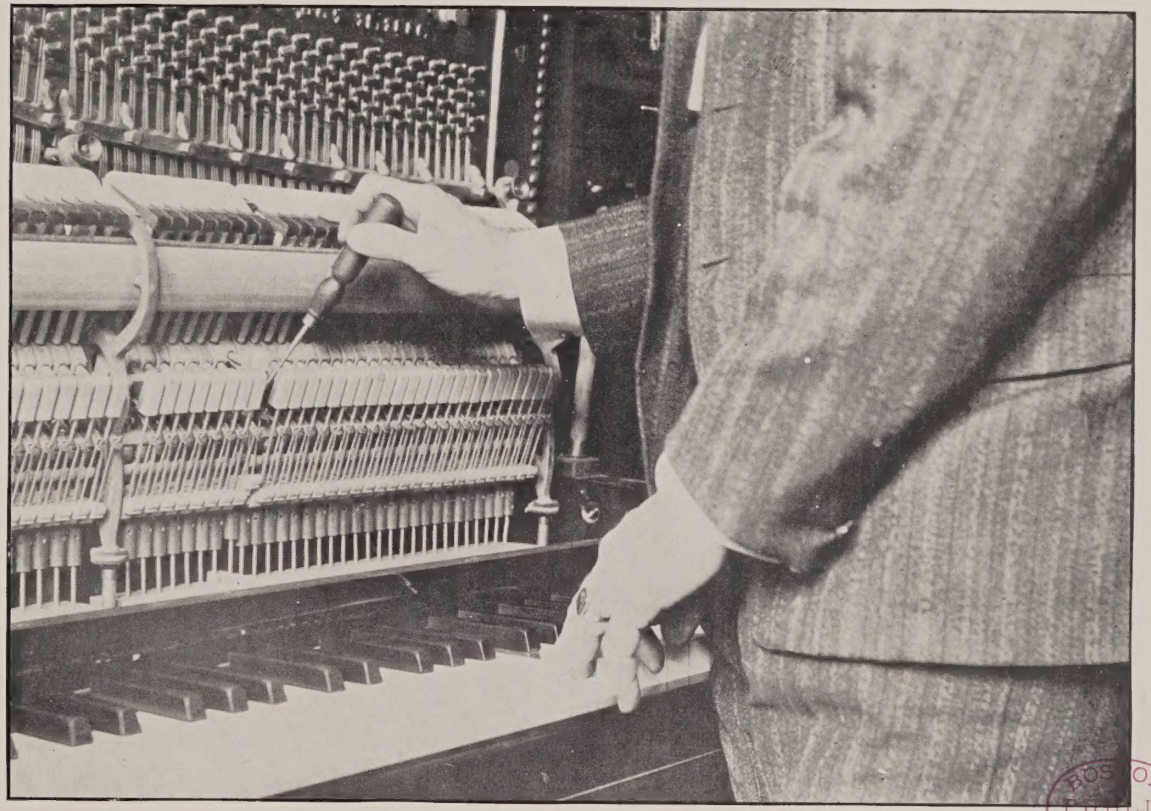

Regulating travel of hammer with regulating screw driver.

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Spacing hammers, when a wooden flange is used on the centre rail.

Tightening action screws.

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Depth of Touch.

How to change depth of touch.

The depth of touch should be three-eighths of an inch. (See photograph to get the depth correct.)

Should the touch be too deep, use thicker punchings until just right. If too shallow, use thinner punchings. If the proper depth of touch cannot be secured with felt punchings, any desired change can be effected by the use of thin paper punchings under the felt ones. If punchings are very thin already, and you still find the depth of touch too shallow, you can make a deeper touch by unscrewing the centre rail and putting a piece of card board under it at the ends and in the centre. Then screw tight again. The higher the centre rail the deeper the touch.

Travel of Hammers.

Travel of Hammers.

Some of the best piano makers have the the piano so regulated that the hammer rests two inches from its end to the string, and after a firm blow, rests one-half inch from the string. When the key is pressed slowly it should travel to within three-sixteenths of an inch of the string in the centre, a trifle less in the treble, a trifle more in the bass before falling back on the back catch. The travel can be regulated by turning the regulating button up or down as the case may be. (See photograph.) The higher the regulating button the closer the hammer will approach the string.

How to regulate Travel of Hammers.

Back Catches.

Back Catches.

The back catches should be bent so as to receive the check squarely. If too close, they will block the hammer against the string. If too far away, the hammer will rebound. If the hammer rests a half inch from the string after a firm blow, it is correct.

Damper Spoons.

Damper Spoons.

The damper spoons should be bent so as to strike in the centre of the damper lever, and should force the dampers about three-sixteenths of an inch from the string. They should begin to move when the hammer has traveled about one-half its distance.

Revoicing Old Hammers.

Revoicing Old Hammers in Upright Pianos.

After a piano has been played on for several years, the hammers will show deep cuts in the felt. This will cause a bad tone. It will improve the quality of tone very much if, by the use of a sandpaper file, they are made perfectly even again, being filed until the point is well rounded. Try to keep the hammers as near the original shape as possible. Then pick the end of the hammer with a felt picker until you get the desired quality of tone. Be careful not to get the tone too soft, as it is a difficult matter to harden again.

To Put On New Hammers.

To put new Hammers on Upright Pianos.

If it is necessary to put on a new set of hammers, the old ones can be taken off either with a tool made for the purpose, or by softening the glue with a flame from an alcohol lamp, being careful not to burn the stem and thus blacken it. The hammers are easily twisted off when the glue becomes hot. In ordering a new set of hammers always send a portion of the old ones as samples. For instance, the first and last of the bass hammers, and the first and last of the centre register, and also the first and last of the treble. This will insure the new ones being bored exactly the same angle as the old ones. It is never

necessary to send the entire set, but state exactly how many are in each register in ordering.

In replacing, see that the hammer fits properly and strikes the strings exact, before the glue is applied.

Replacing Parts of Action.

Replacing Parts of Action.

In replacing broken or worn parts of an action, be sure to use exactly the same size. The repairing of pianos is comparatively easy at this time, as every article needed can be bought from piano-action makers. It is always better to send samples of what is needed, so as to insure getting the exact size.

How to order Felts.

DEFECTS OF AN UPRIGHT ACTION.

Dampers Squeak.

Dampers squeak.

The dampers frequently squeak or have a rubbing noise if worked slowly. This usually is at the point of contact of the spring with the felt. Use the point of a lead pencil on the felt under the spring.

Pedals Squeak.

Pedals squeak.

Pedals frequently squeak, and as there are several springs and also pins holding the trap action in place, all should be gone over carefully. The pins should be taken out with tweezers, black leaded or oiled. You should put a little black lead or soap where the spring comes in contact with the levers. The pedal stick may squeak from friction on its guide pin. Soap-stone is best to use in this case, as it does not present such a bad appearance as black lead. It is well to cover the stick with buckskin at the place where it passes through the guide block. If the pedal squeaks at the heel, unscrew the block, take it off and black lead it. Brown soap will answer the purpose.

Actions Work Sluggish.

Actions work sluggish.

A sluggish action is usually caused by dampness at the flange pins. A drop of kerosene oil at each side will usually remedy instantly.

If this will not answer, insert a smaller centre pin. The oil can be applied from a can made for this purpose.

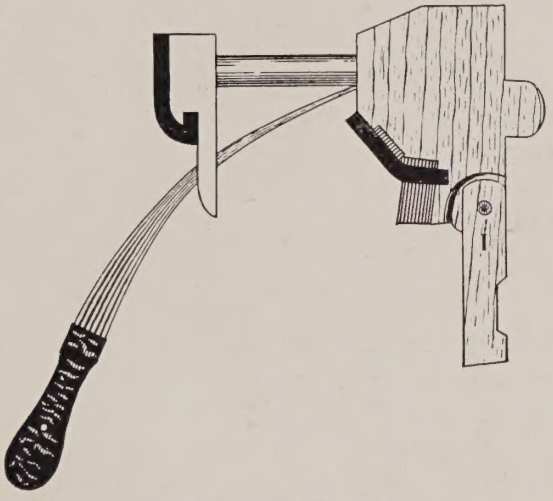
This shows where to put oil when Jack works sluggish.

Hammers Click or Rattle.

Hammers click or rattle.

When glue becomes loose on the hammer stem, twist the hammer off and re-glue it. Hold the stem with a pair of tweezers while twisting the hammer off.

If hammer works sluggish, put a drop of kerosene at part marked "I".



Actions Rattle.

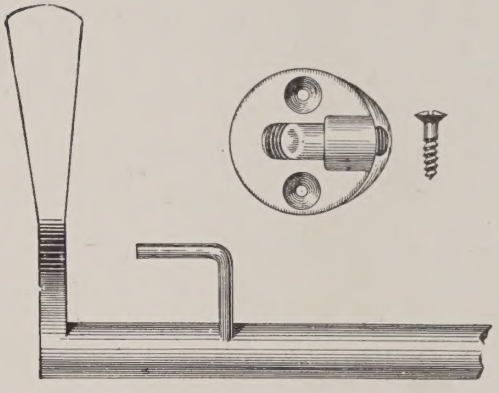
Actions rattle.

In the winter season, if the whole action clicks or rattles from the effects of the heat, take out the action and place it on a table or work bench, and with a screwdriver tighten all the screws. Be careful not to make them so tight as to break the screw head. (See photo.)

Damper Rollers Squeak.

Damper Rollers squeak.

When the damper roller squeaks or has a rubbing sound, a little black lead mixed with oil or vaseline may be placed on it with a small brush or feather. Also put a drop of oil on the flanges which hold the roller to the centre rail.



This diagram shows part of Roller Lever with socket.

Jacks Squeak.

Jacks squeak.

Jacks squeak or rub against the hammer butts when the black lead is worn off, or when the bushing has worn through. Remedy: Replace buckskin and also black lead the same.

Bridle Ribbons.

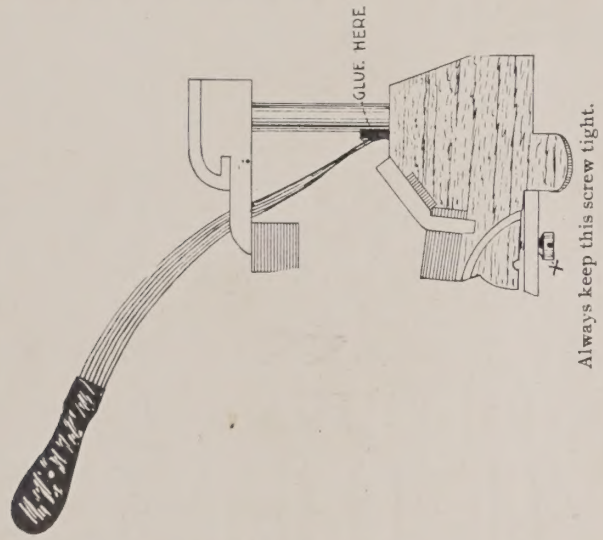
Bridle Ribbons

If the bridle ribbons have become broken, cut the ribbon off close to the butt. Have new ribbon the same length as the old. Put glue on the under side of the back check stem close to the butt.* Draw the ribbon through the back check and fasten it with the glue. Some tuners bore out the back check stem, and put in a new stem, first putting the ribbon in the hole as when the piano was first made.

*See diagram.

This is a difficult task. Others take a very small tack and fasten the ribbon into the hammer butt. This never proves so secure as to glue them.

The diagram shows one style of hammer butt with tape attached. Heavy line shows where to glue bridle tape in replacing.



How to Put in New Bushing.

How to put in new bushing.

Cut a strip of bushing felt one-quarter of an inch wide. Taper to one end. Put it through the hole to be bushed, and draw it through nearly to the end. Then place a little glue and finish drawing it until the glued part is next to the inside of the hole. See that the edges of the felt meet on the inside of the hole. Don't use too much glue; too much glue hardens the felt. Cut the felt off with a very sharp knife, after which the centre pin can be slipped into position.

To Replace Broken Hammer Stems.

To repl brok Hamm Ste

Take out the hammer butt. Carefully dig out the broken part from the butt. Be careful not to split the butt and not to make the hole any larger than the original. In the same way dig the stem out of the hammer. A good way to remove the broken stems is first to use a very small drill, then one a little larger, and so on until the last one is almost as large as the stem. Then dig out the remaining shell with a small blade of a penknife. Cut the new stem the proper length, and roll each end with a rasp before glueing, after properly fitting in the butt and hammer. Use a little glue. Be careful to have the hammer so it will strike the string properly.

Centre Pins—How to Put in.

Centre Pi

If any of the centre pins have worked entirely out of one side, it is better to put in a new pin which is pointed, and can be put through the bushing without pushing it out. Of course, if the pin is only part way out, it can easily be slipped back with the point of a screw driver. If the old pin must be used, it is best to point it a trifle with a file, so it will pass through the bushing without damaging it.

To Replace Ivories and Celluloid.

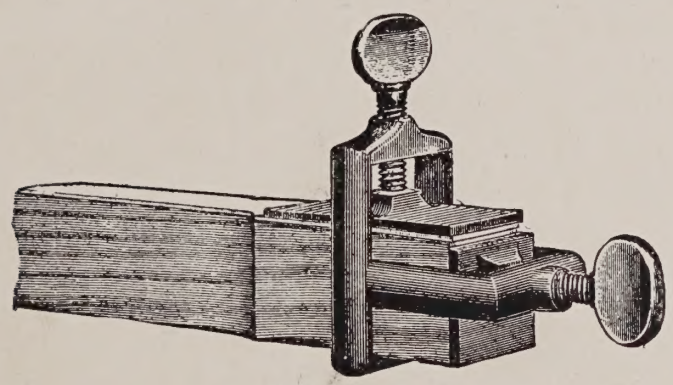
To repla Ivories a Celluloi

The ivories are in three sections—head, tail and front. Oftentimes it is only necessary to replace the head, as the other parts have little wear, and will last a lifetime. The tail, however, may not be so white as the new head. If they are so yellow as to present a very bad appearance, it is better to replace both. These ivories can be purchased already polished for use. First remove the old ivory by

using a thin knife blade, being careful not to cut the wood under the ivory. Put on a thin coat of glue; lay the ivory in position and clamp it until the glue is hard. Clamps for this purpose can be purchased from dealers. If unpolished ivories are used, after glueing on the key they must be filed or scraped until even, and then polished. If polished ivories are desired, samples must be sent with the order.

To lay Celluloid.

To lay celluloid, use only celluloid cement. The celluloid can be purchased in single octaves or in full sets, beveled sheets for tops or fronts. Polish with alcohol and felt, rubbing with force.



IVORY CLAMPS.

Loose Tuning Pins.

Loose Tuning Pins.

If pins are too loose in the block to hold in tune, try driving them a little further in the block. If they are still loose after driving, replace them with new pins a size larger. It is usually better to put in a full new set and new strings at the same time, rather than a few here and there.

Loose Pivot Pins.

Loose Pivot Pins.

Loose pivot pins in any part of the action will cause a rattle or click. This is sometimes a difficult rattle for the tuner to find, as the pin has the appearance of being tight when examined. The only remedy is to put in a larger pin or rebush the hole.

Loose Regulating Rails.

Loose Regulating Rails.

If the regulating rail comes loose at the supports, it will rattle when the jack strikes the regulating button. See that the rail is in proper position and fasten the screws.

First String in Over Strung Bass.

First String in Over Strung Bass.

This string sometimes rattles from the damper block of the next string above coming loose and slipping down the damper wire and striking against it. Remedy: Raise the block high enough so as not to strike the string.

Metal Flange Loose on Hammer Heel.

Metal Flange loose on Hammer Heel.

If the metal flange comes loose it will rattle or click. It must always be tight. This does not cause the hammers to stick as some think.

If the hammers stick, it is because the pin is too tight in the bushing. A drop of kerosene will release it.

Hammers Block in Upright Pianos.

Hammers block in Upright Pianos.

When the regulating button is not low enough to throw the jack from under the hammer butt, it is sometimes caused by a crowding up of the back catch. It is often caused by one or more of the action rails springing, or sometimes the

key bed out of shape, thus forcing the back catch against the back check, blocking the hammer. Remedy: Bend the back catch wires far enough to allow the hammers to fall one-half inch from the string. Hammers will block when the felt on the hammer butt is worn out or misplaced, so that the jack will catch against it.

Injuries Caused by Mice.

Great injury can be caused by mice in an incredably short space of time. They usually get in through the holes in the bottom of the piano near the back castors. It is well to lay the piano on its back and tack wire netting over the holes, also over the hand holes in the back. The bridle tapes are pretty sure to be the first thing to suffer. All other felts and even the woodwork are likely to be damaged. An ounce of prevention is worth a pound of cure. If the bridle tapes are destroyed, see the article on "How to Replace Them." If no help can be secured to lay the piano on its back, take out the under board and cover the holes in the back corners as well as possible with the wire netting.

Injuries caused by mice.

Bass Strings—How to Order.

The bass strings, when taken off, must be kept in regular order. String them on a wire, fasten securely, so when the maker receives them he will have no trouble in making a new set exactly like the old. New sets can be ordered by gauging the first and last string, giving the length of the ends and also wound parts, and stating the number of strings in the full set. It is well, also, to send a drawing to show the hitch and bridge pins. It is always better, however, to send the entire set to the maker.

Bass Strings.

Pitch of Old Pianos.

For old pianos, or those showing weakness in plate, braces, bridges, or case, or one in which strings break or are very rusty, it will be best not to raise the pitch much, if any. Sometimes a piano can be raised by tuning it several times and raising it a trifle each time.

Pitch of Old Pianos.

Removing Broken Tuning Pins.

If a pin breaks or twists off, it can be removed with a bit made for this purpose, which has a back thread cut in it. First file the head of the pin so as to allow the thread to take hold. It will be found easy to twist the pin out. These tools have a square head specially to fit into the end of a tuning hammer.

Broken Tuning Pins.

Re-stringing Pianos.

Strings will frequently become rusty, and it is necessary to replace them.

Re-stringing Pianos.

The first thing is to loosen the wires with the T hammer, and then with the wire cutters cut all the old strings off, leaving about two or three inches of the wire next to the pin. Then with the pliers pull the wire from the pins. Then take out the pins with the T hammer.

Perhaps the most difficult task in re-stringing pianos is in getting the new pin of proper size. They should fit very tight, so as to require driving with a hammer. Frequently when the old pin has been removed, a new pin of the same size will be found too small to hold firmly, and in this case it is best to use a pin the next size larger. Rebore the holes, if necessary, with a pin-bit to fit the new pin. The new strings should be the same number of wire as the

The Grand Piano

The Grand Piano.

The Grand Piano has the most satisfactory action of all, and is best adapted to the highest possibilities of the art of piano building.

The Grand Piano is subject to many defects like those in the Square and Upright.

How to remove Action of Grand Piano

The action is combined with the key board. To remove the action, take out the screws under each end of the piano holding the blocks to which the fall board is attached. Remove the fall board, then draw the action out slowly. To draw the action out usually requires some effort, as there is a spring belonging to the soft pedal action which presses firmly against it on the right hand end. This spring is used to force the action back in position after the soft pedal has been released. Before removing the action, be very careful to see that the hammers are all resting on the hammer rail, and be careful not to press down any keys, as the hammers are liable to be broken by striking against the upper part of the frame or sounding board as the action is drawn out.

Soft Pedal in Grand Piano

The soft pedal moves the whole key board to the right so that the hammers may strike only two strings instead of three. This produces a softer tone. Of course, if this pedal is used much the hammer will wear uneven.

Hammers Flatten.

Lost Motion in Grand Piano

If the hammers flatten much from hard use, repoint them with a sand file. The lost motion can be taken up at the rocker or capstan screw, same as Upright. If any parts stick at the flanges, use a drop of kerosene at the sides of the centre pins.

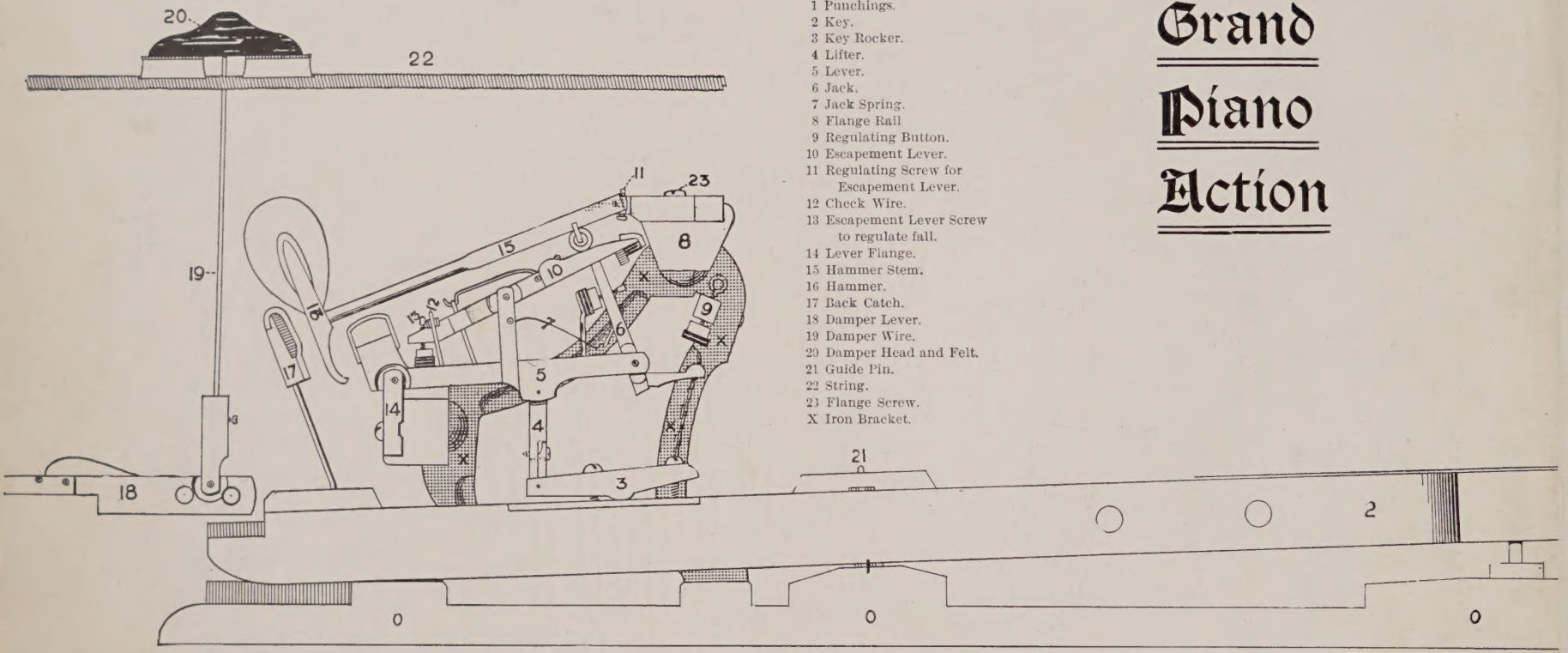
Bridges, sounding boards, pedal actions and other defects can all be remedied like those of the Upright and Square. (See diagram.)

Ear for Music.

Ear f
Musi

It must be understood that while two persons may have equally good hearing, their observations of sound may be different. It is frequently said that a person has "no ear for music," viz.: they "cannot carry a tune." A piano out of tune sounds just as well to them as a piano in fine tune. The tone produced by striking a string with a piece of wood or iron is as satisfactory to their ear as that produced by striking with the best piano hammer. One person appears to hear only what might be termed a "noise," while the correct ear can distinguish the quality of tone and also the pitch, whether high or low, and can also hear the vibrations, pulsations or beats produced when two notes are struck together. Children sometimes possess wonderfully correct ears. Their piano may be tuned without their knowledge, and yet instantly in beginning to play on it they will notice the improvement in tone.

Grand Piano Action

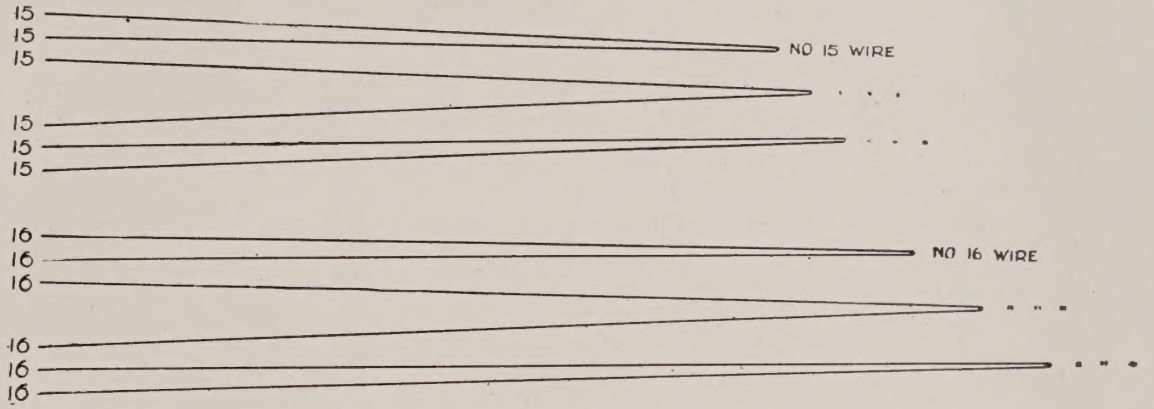


1 Punchings.
2 Key.
3 Key Rocker.
4 Lifter.
5 Lever.
6 Jack.
7 Jack Spring.
8 Flange Rail
9 Regulating Button.
10 Escapement Lever.
11 Regulating Screw for Escapement Lever.
12 Check Wire.
13 Escapement Lever Screw to regulate fall.
14 Lever Flange.
15 Hammer Stem.
16 Hammer.
17 Back Catch.
18 Damper Lever.
19 Damper Wire.
20 Damper Head and Felt.
21 Guide Pin.
22 String.
23 Flange Screw.
X Iron Bracket.

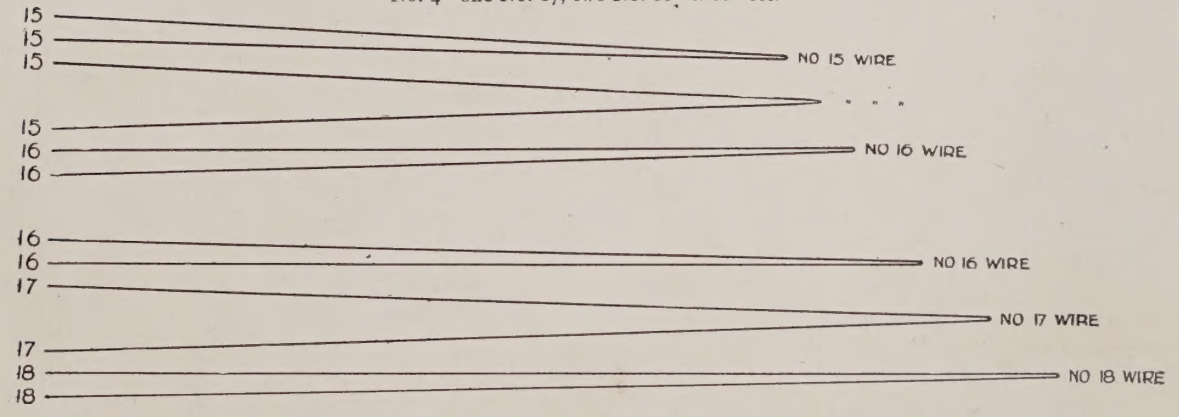
old. The numbers are frequently marked near the pin holes, showing the exact number used by the maker; but in case this has not been done, it will be found easy to gauge the wires and thus be sure of the size. One important point in restringing is to have all three strings exactly the same size. (See diagrams.)

It is very difficult to tune unisons, unless the wires are all the same number.

This diagram shows the correct method of stringing a piano. It is observed the three strings of each group have the same size wire.



This diagram shows an incorrect method of stringing a piano. It will be observed :
No. 1—all No. 15—correct.
No. 2—one No. 15, two No. 16—incorrect.
No. 3—two No. 16, one No. 17—incorrect.
No. 4—one No. 17, two No. 18—incorrect.



Broken or Cracked Bridges.

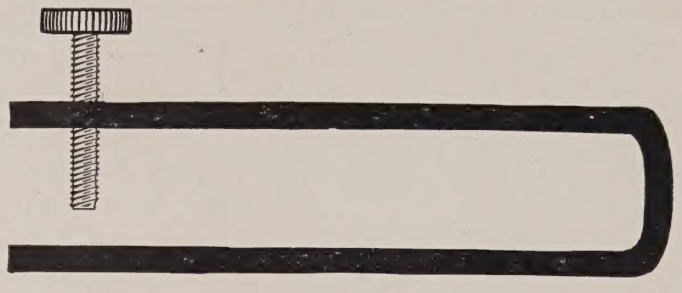
Broken or cracked Bridges.

To repair broken bridges is a task requiring great skill. If the bridge is put together in sections, and the glue has become loose, take off enough strings to allow room for the screws. Then, with a thin knife-blade, work some glue between the parts and screw together firmly. Wipe off the surplus glue.

The screw heads must be counter sunk so as to allow the strings to be properly replaced. If a bridge is badly cracked, nothing can be done but to put in a new one. The best wood must be used and it must be shaped exactly like the old.

Clamps for Bridges.

A clamp can be made for glueing on bridges especially in square pianos; and it will be found very useful. Make out of inch-and-a-quarter or inch-and-a-half iron. Have a screw-thread cut through one end and screw to fit the same. The clamp can be made any desired size. (See diagram.)



A clamp like this diagram can be made by any machinist and of any desired size. It will be found useful especially in repairing broken bridges in square pianos where a long arm clamp is needed.

Setting the Temperament

Setting the Temperament.

In beginning to practice tuning the piano, it is recommended to use the international pitch, c=517.3; a=435, as this pitch is now universally adopted as the standard. (See pitch.)

If the beginner is practicing upon an old instrument, he would be much less likely to break strings by using this pitch than with the use of the old standard high concert pitch.

It is also recommended that the student have the use of an organ in beginning to learn the tune; of course, it must be in good tune. Just as a person would never learn to swim by constantly holding on to something, neither could one learn to tune by depending always upon another instrument. It is an excellent thing, however, to have either an experienced tuner or instrument to aid in discovering where any defect may be in the work.

System of Tuning in general use.

The system of tuning by fifths and fourths is the one in general use. Some years ago tuners nearly always tuned by fifths and octaves, not using the fourths, but it proved to be a very roundabout way, and it was tedious to discover any error. The "fourth" is quite as easy to tune as the "fifth," after the ear has become accustomed to it. By the use of fifths and fourths the bearings can be laid by using only one octave.

To Tune the Unison.

A student should first learn to tune the unison. The Square Piano has two strings to each note, and the Upright and Grand have three to each note, except in the bass. If the left hand string is tuned first, a wedge must be placed between the two remaining strings to dampen them. To tune the middle string, place the wedge so as to dampen the third string; after which remove the wedge and tune the remaining string. Some tuners, however, tune the middle string first by putting a wedge so as to stop the vibrations of each outside string, afterward tuning the first and third. If the unisons are much out of tune, the vibrations, pulsations (or beats) will be quick in proportion as they are out of tune, and will become slower as they approach the perfect. Unisons are perfect when all the vibrations have disappeared and all three strings, when struck together, sound as one, and the tone is smooth and clear.

To Tune Octaves.

After mastering the unison, next practice tuning the octaves. The two notes, when in perfect tune, must sound as one, the upper note being completely swallowed up, as it were, in the lower.

To Tune Fifths and Fourths

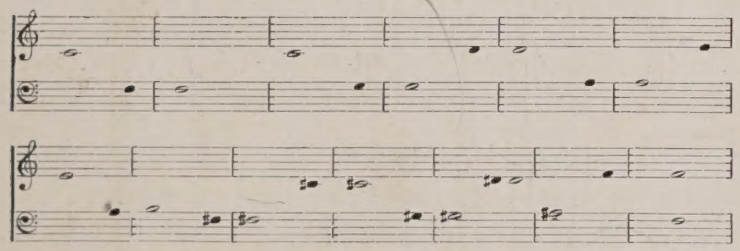
Now practice tuning the fifths and fourths. It is a well-known fact that fifths and fourths must not be tuned

perfect. If you tune a series of perfect fifths and fourths, the upper *f* will be too sharp to prove a perfect octave to the ' ' First learn to tune them perfect, then flat them you hear three long waves terminating in one continuous sound. By making the fifths and fourths perfect, then flatting them, the ear will soon become accustomed to the degree of flatness.

The fact that a fifth or fourth will beat the same whether sharp or flat makes it necessary to first make them perfect. The student should persist in practicing until every time he sets a temperament it proves the same. No amount of genius will ever compensate for the lack of practice. A person may understand thoroughly the theory of sound and music, and be able to demonstrate clearly by mathematics the exact amount of flatness required in each fifth and fourth, and yet not be able to lay the bearings of a piano.

It is a well-known fact that teachers of Physics, who stand at the head of their professions and can demonstrate to their classes all the whys and wherefores in regards to the musical scale, could not possibly tune a piano. To repeat, practice only will enable the student to tune perfectly.

Temperament.



First, tune middle *c* to the tuning fork, then tune *f* below a sharp fifth to this *c*. It is well to tune this fifth perfect at first, and then raise the *f* until the vibrations quicken, or until you make it too sharp, after which lower it until there are three long waves. In tuning the following fourths and fifths, make them perfect, then flat them until you can hear three long waves terminating in one continuous sound or three waves in five seconds.

Next tune *g* fourth below, a little flat.
Next tune *d* fifth above, a little flat.
Next tune *a* fourth below, a little flat.
Next tune *e* fifth above, a little flat.
Next tune *b* fourth below, a little flat.
Next tune *f* sharp fourth below, a little flat.
Next tune *c* sharp fifth above, a little flat.
Next tune *g* sharp fourth below, a little flat.
Next tune *d* sharp fifth above, a little flat.
Next tune *a* sharp fourth below, a little flat.
Next tune *f* fifth above, a little flat.

This *f* should be a perfect octave to the *f* below. After the temperament has been set, tune by octaves the bass and treble.

This is the most satisfactory system of equal temperament in use.

Should this *f* prove defective, it is better to go over the entire temperament again, as it is almost impossible to repair any one interval. Of course, there are times when a new string might flatten during the laying of the temperament, and could be corrected without going over it all. Should the upper *f* prove too sharp for the octave below, it is evident the fifths and fourths have been made too sharp or too perfect, and in this case it is well to descend through the circle by lowering each one enough to give the three long beats. You will often quickly discover the defective interval.

Should this system of temperament be followed exactly, there will be no need for trial chords, as they will all prove correct if the fifths and fourths are correctly tempered.

System for Lowering of Pitch.

System for Lowering of Pitch.

Should a piano be too high in pitch, and the whole is to be lowered, the easiest and most effective way would be, after tuning the middle *c* to the desired pitch, to tune the *f* below a sharp fifth, then tune the octave *f* above perfect to the *f* below, then descend through the circle of fifths and fourths as follows, leaving each one sharp, according to the foregoing rules:

Tune *a* sharp a fifth below.
d sharp a fourth above.
g sharp a fifth below.
c sharp a fourth above.
f sharp a fifth below.
b a fourth above.
e a fourth above.
a a fifth below.
d a fourth above.
g a fifth below.
c starting point.
This *c* must prove a good fourth, as it cannot be altered.

Another System for Setting the Temperament.

The following system for setting the temperament is often used, and taught in schools of tuning:

Tune middle *c* to the fork; then tune *f* below a sharp fifth, three beats in five seconds.

Next tune *g* fourth below, flat, one beat a second.

Next tune *d* fifth above, flat to *g*, three beats in five seconds.

Next tune *a* below, a flat fourth, one beat a second.

Next tune *e* above, a flat fifth, three beats in five seconds.

Next tune *b* below, a flat fourth, one beat a second.

Next tune *f* sharp below, a flat fourth, one beat a second.

Next tune *c* sharp above, a flat fifth, three beats in five seconds.

Next tune *g* sharp below, a flat fourth, one beat a second.

Next tune *d* sharp above, a flat fifth, three beats in five seconds.

Next tune *a* sharp below, a flat fourth, one beat a second.

Next tune *f* above, a flat fifth, three beats in five seconds.

Now comes the testing time; this *f* should be a perfect octave to the *f* below. Next tune treble and bass by octaves.

To lay bearing on one string first.

It is well to practice laying the bearings, using only the one single string (the left hand one) throughout the entire octave by putting a wedge between the two remaining strings of each note; and after the bearings are laid and found correct, then tune the unisons throughout the entire octave. This makes it quicker to correct any error, as in going over the bearings there is only one string to change instead of three, or thirteen instead of thirty-nine. Some tuners follow this rule all through their profession.

If any difficulty is experienced at first in hearing distinctly the beats in the fifths and fourths, a little practice on the organ will soon cultivate the ear, the beats on the organ being much more distinct to the beginner than those on the piano.

A simple mathematical demonstration is added to give the student an idea of how much flatness is to be distributed evenly among the fifths and fourths.

Represent the length of a string necessary to sound middle *c*, as one or unity. Now $\frac{2}{3}$ of this will represent the length that will sound the fifth *g* a perfect fifth.

$\frac{2}{3} \times \frac{2}{3} = \frac{4}{9}$, the length to sound *d* fifth above *g*.

Double this to get the octave below. $2 \times \frac{4}{9} = \frac{8}{9}$. $\frac{8}{9} \times \frac{2}{3} = \frac{16}{27}$ gives *a*, the fifth above.

$2 \times \frac{16}{27} = \frac{32}{27}$, doubled to give octave below.

$\frac{32}{27} \times \frac{2}{3} = \frac{64}{81}$ gives fifth *e*.

$\frac{64}{81} \times \frac{2}{3} = \frac{128}{243}$ gives fifth *b*.

$\frac{128}{243} \times 2 = \frac{256}{243}$, doubled to give octave below.

$\frac{256}{243} \times \frac{2}{3} = \frac{512}{729}$ gives fifth *f* sharp.

$\frac{512}{729} \times 2 = \frac{1024}{729}$, doubled to give octave below.

$\frac{1024}{729} \times \frac{2}{3} = \frac{2048}{2187}$ gives fifth *c* sharp.

$\frac{2048}{2187} \times \frac{2}{3} = \frac{4096}{6561}$ gives fifth *g* sharp.

$\frac{4096}{6561} \times 2 = \frac{8192}{6561}$, doubled to give octave below.

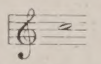
$\frac{8192}{6561} \times \frac{2}{3} = \frac{16384}{19683}$ gives fifth *d* sharp.

$\frac{16384}{19683} \times \frac{2}{3} = \frac{32768}{59049}$ gives fifth *a* sharp.

$\frac{32768}{59049} \times 2 = \frac{65536}{59049}$, doubled to give octave below.

$\frac{65536}{59049} \times \frac{2}{3} = \frac{131072}{177147}$ gives fifth *e* sharp.

$\frac{131072}{177147} \times \frac{2}{3} = \frac{262144}{531441}$ gives fifth *b* sharp or *c*.



It is evident this *b* sharp or *c* is too sharp to form a perfect octave to middle *c*. To be a perfect octave the fraction should be $\frac{262144}{524288}$ or $\frac{1}{2}$.

The former fraction, $\frac{262144}{531441}$, represents a shorter string and, therefore, a higher pitch. Each fifth must therefore be depressed $\frac{1}{12}$ part of this diatonic comma to make a perfect octave.

Second Demonstration.

In the octave *c* to *c*, there are three intervals of a major third each: *c* to *e*, *e* to *g* sharp, *g* sharp or *a* flat to *c*.

Representing the length of the entire string to produce the octave as one or unity, then *c* to *e* will be equal to $\frac{4}{5}$ of that length.

e-*g* sharp will equal $\frac{4}{5} \times \frac{4}{5}$ or $\frac{16}{25}$. *a* flat to *c* $= \frac{16}{25} \times \frac{4}{5} = \frac{64}{125}$.

Now to produce a perfect octave, the fraction would be $\frac{64}{128}$.

The fraction $\frac{64}{125}$ would represent a longer string, and thus a lower tone than $\frac{64}{128}$, which would produce the octave.

Thus all major thirds must be tuned a trifle sharper than perfect, expressed by the ratio 128 to 125.

Standard Pitch.

Standard Pitch.

At a meeting of the Piano Manufacturers' Association of New York and vicinity, held November 6, 1891, New York City, the International Pitch, $a = 435$, $c = 517.3$, was unanimously adopted, the same to take effect July 1, 1892, as a universal standard.

By whom Tuning Fork was invented.

The tuning fork was invented by John Shore, a sergeant trumpeter in the service of King George I of England, in 1711. A rude tenor fork is still in existence, $c = 419.9$.

It is well to know something about the pitch used in the past.

Händel's Fork.

Händel's fork was $a = 422.5$, in 1751. This fork is in the possession of Rev. G. T. Driffield, at Old, near Northampton.

Mozart's Fork.

Mozart's fork, made by Kleim, of Vienna, in 1780, was *a* 421.6.

Wagner's Pitch.

An organ in Bayreuth was tuned for Wagner, $c = 522$.

Patti's Fork.

The fork used by Patti in a concert tour in America, was $c = 520.5$.

Sankey, Stebbins and McGranahan's Fork.

A fork used by Messrs. Sankey, Stebbins and McGranahan, to which was tuned an organ used by them in the preparation of their late editions of "Gospel Hymns," was $c = 522$.

Koenig's Fork.

A *c* fork used by Koenig, 517.3 vibrations, of the equalled tempered scale, was based upon $a = 435$.

Philharmonic Pitch.

Händel's pitch was no doubt controlling in the earlier part of the century. Upon the certificate of Mr. Pepercorn, a tuner of Broadwoods, who tuned for the original Philharmonic Orchestra concerts in London, 1813 to 1820, from a fork agreed upon by the members of the orchestra, we find the mean Philharmonic pitch to have been $a = 423.5$, and remained at that standard until Sir George Smart became the leader of the society in 1820.

In 1828, Sir George Smart caused to be constructed a fork, $a = 433.2$, as the standard of the Philharmonic Society. It became the one in general use in the shops of London, and on sale in the stores, until 1845, as the London Philharmonic.

Sir Michael Costa's change of Pitch.

In 1845, Sir Michael Costa succeeded to the leadership of the Philharmonic Society, and began immediately to create a name and distinctive place for himself by raising the standard of the Philharmonic pitch until it reached the enormous elevation of $a = 454.7$, where it has remained with only slight variations.

Pitch of English Military Band.

The pitch of the English military bands is fixed by the Queen's regulation in the following language:

"In order to insure uniformity throughout regimental bands of the service, the instruments are to be of the same pitch as that adopted by the Philharmonic Society."

The English Government appointed a committee consisting of the late Dr. A. J. Ellis and A. J. Hipkins to determine that pitch, who fixed upon $a = 452.5$, and tuned a fork representing the same. Upon the death of Mr. Ellis, the Government placed in the hands of Mr Hipkins the important matter of the preservation of that standard, who caused to be constructed suitable standard forks.

Upon the continent of Europe; where they had been for nearly 200 years in possession of a tolerably uniform pitch, the year 1814 ushered in a change; it was that year when the crowned heads of Europe assembled in that notable and now historic congress of Vienna.

Pitch of Austrian Band.

The Emperor of Russia presented to the brass band of one of the Austrian regiments, of which he was the honorary colonel, a new set of instruments. As he marched in review at the head of his regiment, it was noticed that the band was upon a much higher pitch; it was learned that the instruments had been made much sharper than any other instruments previously in use. One of the Austrian Grand Dukes, not to be outdone, presented one of the three household regiments of Austria another set of instruments that were still sharper.

Military Bands of Vienna.

The two opera houses of Vienna were dependent upon the military bands, and the confusion that here began resulted in the raising of the pitch of the orchestra at the opera at Vienna.

It was the beginning of the confusion, and of the slow but certain raise, through great difficulties (for the people of that day were a tenacious people), which crept slowly westward permeating many localities, reaching into France and England, influencing Sir George Smart in London in adopting the pitch he did adopt, and was completed only when Sir Michael Costa attempted to climb the heights of fame by first sending the pitch heavenward, to be obliged in the cold and dreary month of February, in the very middle of the concert, when the pitch of his orchestra, by the rising temperature of the room had completely run away with him, to stop his concert, arrest the pitch, retune his instruments and begin again.

The ultimate result was to cause the pitch of the orchestra to be fixed at $a = 452.5$.

Pitch in Boston, 1880.

A paper of historic importance upon this subject was written by Messrs. Cross and Miller, giving an account of the condition of musical pitch in Boston and vicinity in the year 1880.

At that time there existed in that city more than thirty standards of pitch, reaching from Koenig's physical pitch of $c = 256.1$ to that of the New York pitch of $c = 273.9$.

Chickering & Son's Fork.

Of all the forks in use in Boston and vicinity, quite likely the standard fork of Chickering & Sons, giving

$c = 268.5$, is the most important, and has had during the last quarter of a century more influence upon the musical pitch of Boston than any other fork.

Mason & Hamlin's Fork. Geo. Wood's Fork.

From it Mason & Hamlin copied their fork, and George Woods copied his from Mason & Hamlin's, and from these forks other manufacturers of Boston have very largely obtained their standards, save the Smiths, who copied theirs from the opera, 1866.

Steinway Fork. Weber Fork.

We find the forks representing the pitch of Steinway, Weber and others, at about the same period, based upon the oboe, then in use by the Philharmonic Society, $c = 270$, and around them there is grouped a large and distinctive circle of manufacturers.

Messrs. Steinway possess a higher fork, viz.: $c = 272.2$ and $a = 455.9$, which would be higher than that of the Philharmonic Society of London under Sir Michael Costa.

There also prevails in New York a still higher fork of $c = 274$; in Baltimore, $a = 456.1$; in Philadelphia, $c = 547.8$; in Bridgeport, $a = 458.1$.

Estey's Fork.

If we go to the reed organ manufacturers, we shall find the Messrs. Estey for many years using $c = 261$. We also find Mason & Hamlin, of Boston, using $c = 259$ after the first introduction of the great organ at the Music Hall in that city, and then returning to the pitch taken from the Chickering fork.

Pipe Organ Pitch.

If we examine into the pipe organ manufacturers of the country, we find great care has been exercised, and low pitch has largely prevailed. There is one manufacturer who furnished a list of 279 pipe organs tuned from $a = 435$, and all of the pipe organ manufacturers of today stand substantially upon this pitch.

The artists of the world ever made protest against the rise in pitch. At Vienna where it reached as high as $a = 456.1$, being three-quarters of a tone higher than that of Mozart, artists refused to go to the stage. At Paris, Madam Branshu refused to go upon the platform. In 1857 and 1858 an alarm took place causing such a fright that singers refused to appear upon the stage unless the pitch was lowered. This mania spread through Europe, first at Vienna and then at the French Opera in Paris, where a had reached 448; artists rebelled, and the musical world came to their rescue, consternation took the form of a panic. An appeal was made to the French Government, who appointed a commission to investigate the whole subject, who reported in 1859 in favor of $a = 870$ single vibrations in a second, resulting in a decree on February 16, 1859, establishing that rate as a standard for France.

Artists opposed to high pitch.

When Richard Wagner went to London in 1877 to preside over the greatest festival that he had ever given in England, he found the pitch of the orchestra had gone to $a = 455.1$, and made a serious protest, finding extreme difficulty in conducting on that occasion.

In 1879, Madam Patti entered her protest and refused to sing without the lowering of the pitch. In the same year, Madam Nilsson entered a protest.

In 1860, the Russian Government ordered the national orchestra to reduce the pitch to $a = 870$ single vibrations; but little progress, however, was made in an official way, except by two or three of the smaller states, until 1885, when, upon the petition of those interested in the subject at Vienna, the Austrian Government called together an important congress, at which the Governments of Russia, Germany, Italy and many other states were represented, and resulted in the decision of the commission recommending the adoption as an international pitch of $a = 870$ single vibrations.

In 1885, the New York Philharmonic Society adopted $a = 435$ as the standard pitch of that orchestra. The Symphony Orchestra of Boston adopted the same.

Music Teachers' Association Pitch.

The National Music Teachers' Association passed this resolution in 1889:

Resolved: That all pianos not tuned to $a = 435$ be excluded from the concerts of this Association.

The adhesion of the American College of Musicians is also assured.

The National League of Musicians, which has its important locals in 48 cities of this nation, controlling 12,000 musicians, has adopted the low pitch $a = 435$.

Table of Pitches Used.

In order to show how the pitch has varied in the past in the absence of a standard, we add the following list.

C FORKS

Roosevelt Organ Works, New York,	C4 Fork	516 8
J. H. & C. S. Odell, New York,		520.6
J. H. Foote, New York,		535·4
Geo. Steck & Co., New York,		539·5
Wm. E. Wheelock & Co., New York,		539.6
Decker Bros., New York,		539·9
Estey Piano Co., New York,		540.
R. M. Bent & Co., New York,		540.1
Mehlin & Sons, New York,		540.2
Pease Piano Co., New York,		540.4
Newby & Evans, New York,		541.
Hazleton Bros., New York,		542.3
Decker & Son, New York,		542 3
Mason & Hamlin, Boston,		537 7
C. C. Briggs & Co., Boston,		537 7
Vose & Sons, Boston,		537 8
McPhail Piano Co., Boston,		538 6
Chickering & Sons, Boston,		538 8
Chickering & Sons (Low),		521.2
C. B Snyder, Winfield, Ks,		518 4
Jewett & Co., Leominster, Mass.,		533·
Gallup & Metzger, Hartford, Conn.,		534·5
Sheninger, O. & P. Co., New Haven, Conn.,		534·5
Boardman & Gray, Albany, N. Y.,		539·5
Leicester Piano Co., Leominster, Mass.,		550.9
Estey Organ Co., Brattleboro, Vt.,		517·3
Estey Organ Co., Brattleboro, Vt,		522.
Estey Organ Co., Brattleboro, Vt.,		540.
Knabe & Co., Baltimore, Md,		508.8
Knabe & Co., Baltimore, Md.,		541.3
Wilcox & White Organ Co., W. Meriden, Conn.,		532.6
Lester Piano Co., Philadelphia, Pa.,		547.8
Clough & Warren Organ Co, Detroit, Mich,		538.6
Atlanta Piano Co., Atlanta, Ga.,		539.1
A. B. Chase Piano Co., Norwalk, O.,		540 8
Sherman, Clay & Co., San Francisco, Cal,		545·4
J. & C. Fisher, New York,		526.2
Frances Bacon, New York,		536.4
Albert Weber, New York,		537·5
Benning & Sons, New York,		538.1
Behr Bros., New York,		540.
Coniver Bros., New York,		542 8

A FORKS

Mason & Hamlin, Boston,	A3 Fork	435.
Mason & Hamlin, Boston,		439.
J. H. Foote, New York,		449·5
Chas. M. Steiff, Baltimore, Md.,		456 1
P. Werlein, New Orleans, La.,		431 8

C. H. W. Ruhe, Pittsburg, Pa,	442.2
Clough & Warren Organ Co, Detroit, Mich.,	444 9
Hook & Hastings, Boston, Mass.,	443.8
W. W. Kimball Co., Chicago,	451.7
Keller Bros. & Blight, Bridgeport, Conn.,	458.1
Steinway & Sons, New York,	455.9
Krakauer & Bros., New York,	454.7
Sohmer & Co., New York,	454.5
Hallett, Davis, & Co., Boston,	453.4
George Jardins & Co., New York,	447.5
Kranich & Bach, New York,	445.

Why Pianos Get Out of Tune.

Why Pianos Get Out of Tune.

The tuning pins may be loose, or the block defective.

Strings may be new and thus stretch.

The strings may not fit properly, viz.: One may lap over the next one at the ends, or may touch against the next pin The string in either case will not be solid, and a heavy blow will knock it out of tune.

The bridge pins may give more or less.

The strings may cut into the bridges.

The case may not be well seasoned.

The frame work may be cracked.

The bridges may be loose.

Bad tuning is frequently the cause. The tuner may be thoroughly honest, and yet lack practical knowledge.

Distribution of Tension.

The tension should be properly distributed over the entire length of the wire. This would be the case if the string was free from the tuning pin to the hitch pin; but it passes under a pressure bar or through an agraff and then through the bridge pins. It is at these points where the difficulty arises. When a string is tuned it is first tightened between the tuning pin and the pressure bar or agraff. The string, in order to pass through this bar or bridge pins, must more or less deviate from its straight course, and thus more or less friction occurs against the edge of the bar or pins where the string touches, the string "sticking" or "holding on." In raising the pitch of the string the tension will be much greater from the pin to the bar than from the bar to the next bridge pin. A heavy blow from the hammer against the string will release this tension and then immediately is out of tune, caused by a distribution of the tension over the entire string. The same difficulty exists at the hitch pin end, but is not usually so pronounced as at the tuning pin end. If a piano under these conditions is lowered much in pitch, it is likely to go lower after tuning. If raised much, it is likely to go higher, often as much as one-quarter of a tone. Slight changing of pitch is not likely to affect it seriously, because the change of tension is slight at the pin end. The tuner must give each key a heavy blow, so as to affect the whole string, and wait a moment to see if there is any "give." After one or more octaves are tuned, go over the previous octave, and by this time it will be likely to show any defects. If the pressure bar is rusty or strings rusty, it is difficult to tune a piano, and never holds well.

Varnishing Piano Case.

Varnishing Piano Case

It is necessary to provide yourself with the best piano polishing, and also rubbing varnish. It is never saving anything to buy a cheap article. The same may be said of the brush. A poor brush will spoil the best work. It is likely to be dirty and have loose bristles, and is never half

so satisfactory as the best. If the piano case is in reasonably good condition, it can be thoroughly washed, and thus made ready for the first coat of rubbing varnish. If the old varnish is peeling off or badly cracked, it will save time and make a much finer job to scrape the old varnish off entirely, then sandpaper until smooth. The most successful varnishing will result from keeping everything perfectly clean and free from dust. A varnish brush should be washed in turpentine two or three times before being used. The cup also containing the varnish should be washed out clean with turpentine. Apply the first coat of varnish, work with brush until all is covered and thoroughly smooth, using the brush lightly from end to end. Then allow it to stand for three or four days. A week is better. After which cut with pummice stone and water applied with a piece of quarter inch felt. Then wash thoroughly with a sponge and wipe with a chamois. Then apply the second coat, and so on until it is quite smooth; begin with the polishing varnish, applying as many coats as necessary to make a smooth job, cutting each coat with pummice stone, and the last coat with rotten stone. Finish the polishing with lamp black and sewing-machine oil. Don't try to hurry varnish. Allow each coat to become perfectly hard. To be able to do fine work a person should first see an experienced varnisher do the work or practice on some old work that is not particular. Practice will make perfect.

Cracked Iron Frames.

Cracked Iron Frames.

If a crack occurs in the flat surface of the iron frame, it can be repaired and made as strong as formerly. Of course, if the iron arms or braces should crack loose from where they are joined to the frame, nothing can be done to repair it. To repair the frame, take it out and have a plate made of one-quarter inch iron to fit over the crack, allowing it to extend, say three inches outside the crack. Then have from four to six quarter inch holes, with screw threads cut in the plate, two or three on each side of the crack. Drill holes in the frame directly opposite; put screw bolts through from the under part of the frame and draw tight. It makes a much better job when screw threads are cut, than to put bolts through with nuts on them. If the screw bolts extend too far through, file off until even. The crack will usually close after the frame is taken out of the piano. Holes should be drilled through the plate extending through the iron frame, so that after the frame is put in the piano a few screws can be put through to secure to the frame of the piano. If the crack occurs at the pin holes, make an impression on paper of the holes; glue this on a piece of thin board and drill holes through. This will serve as a pattern for the machinist to insure having the holes in the right place. Have the screw thread holes cut so as not to interfere with the pin holes. It will perhaps be necessary to use a tuning pin a quarter or half inch longer to compensate for the thickness of the plate. Re-gild the whole frame. If a crack occurs in the brace, it can be made secure by bolting a piece of one-quarter inch iron on each side of it. It is also better in this case to have screw threads cut in one of the iron strips.

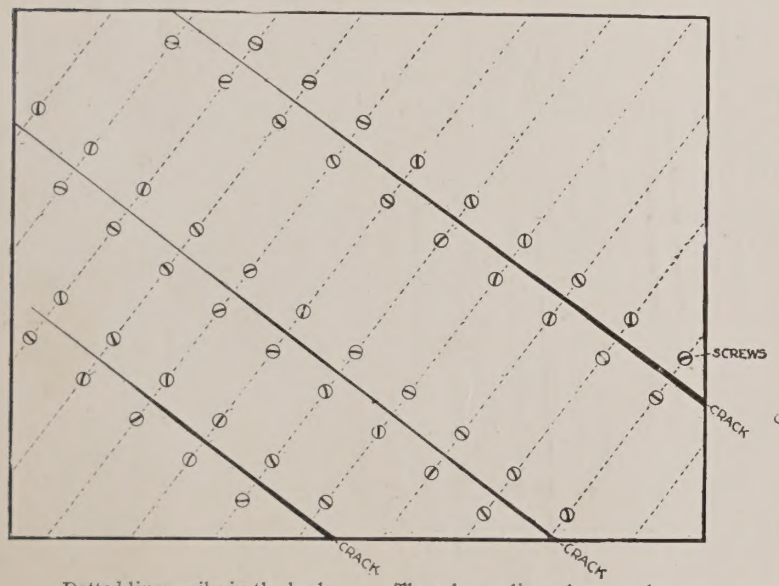
Cracked Sounding Boards.

Cracked Sounding Boards.

Sounding boards crack badly from severe changes in temperature. If a board becomes very damp and then is dried quickly, it is most sure to crack; it usually comes loose also from the ribs on each side of the cracks. This

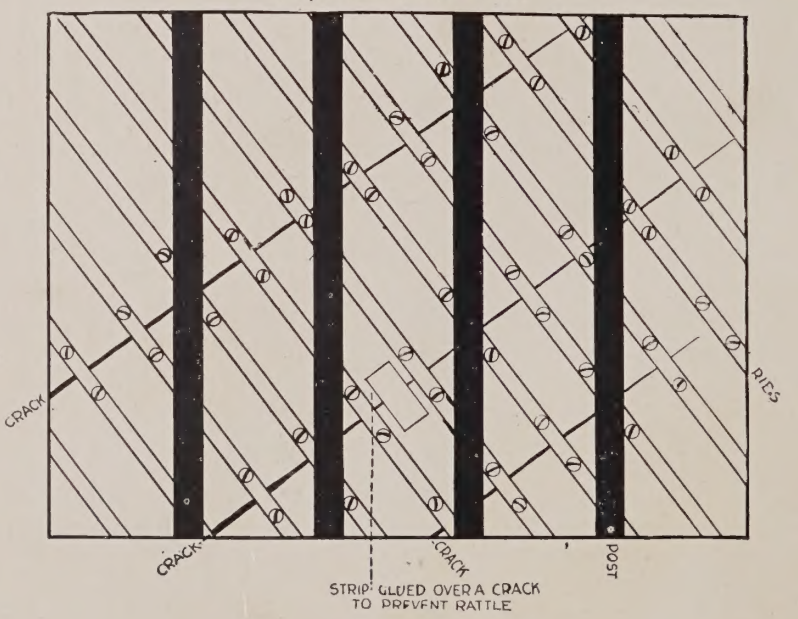
causes a rattle or buzzing noise when playing on the piano. These cracked boards can frequently be repaired and made to last for years. Take a very small drill and put a hole through the rib on each side of the crack. Allow it to extend through the board. This will make sure the position for drilling the hole for the screw. Have a sounding board button and a screw long enough to reach nearly through the rib. Drill hole for the screw. Then with screwdriver put the screw in position. See if the rib and board are drawn tight together; if so, take the screw out and with a thin knife blade run some glue under the rib. Apply glue to the sounding board button, and also to the screw. Then drive the screw in firmly. This will make a permanent job. This should be done on each side on the rib. Cracks sometimes come under the iron frame or back of the posts so as to make it impossible to get at them without taking out the iron frame. Complete repairs can frequently be made without even taking the piano from the parlor. It is better to put in the screws from the front of the board; but if this is impossible, it can be put through the rib from the back. Put glue under the rib as before, and see that the rib is drawn tight to the sounding board. It is rare that a board will rattle after these repairs are made. If such should be the case, by pressing the board with the fingers you will soon detect what part rattles. Place over the cracked part a thin strip, glue and screw tight.

Diagram showing a cracked Sounding Board from the front.



Dotted lines—ribs in the back. Three heavy lines show cracks.

This diagram shows where to put the screws in the ribs when screws are put in from the back.



Bass Bridges.

Bass Bridges.

The bass bridge frequently comes unglued from the sounding board. The proper way to make a complete job is to take the bass strings off. The bridge can then be taken off. See if it is warped; if so, plane until it fits perfectly, then glue in position. Secure by putting in from three to six screws. It is better to put on an entire new set of bass strings. Sometimes the bridge can be secured without taking off the strings or without glue, by using two or three screws, but is never so satisfactory.

Caring for the Piano.

Caring for the Piano.

Pianos should be kept at one pitch (or close to it) constantly, as they will stay in tune much better than when the pitch is changed often. The question is often asked: How often should a piano be tuned? Surely four times a year. Keep thoroughly clean, free from dampness or extreme heat, closed when not in use, wipe keys often with a damp chamois. Secure the services of a conscientious tuner, who will not slight his work; nothing is worse for a piano than poor tuning; nothing is saved by allowing the piano to go for years without tuning. It will usually fall so far below pitch that it can perhaps never be raised again.

Checking of Varnish.

Checking of Varnish.

This is caused by dampness or the wood not being properly seasoned. The surface becomes rough like a file. When seriously checked, scrape off varnish. Use a filler after scraping. Then proceed to varnish. (See Varnishing Pianos.)

A Slight Scratch or Bruise.

A Slight Scratch or Bruise.

Rub with sandpaper and oil until smooth. Touch up with varnish.

A Deep Bruise.

Deep Bruise or Scratch.

Use gum shellac. Heat over a match flame, drop into the hole until level. Rub down with pumice stone and water. Touch up with varnish.

Mahogany Stain.

Mahogany Stain.

To make a pint of mahogany stain use ten cents worth of Bismarck brown. Put it in a bottle. Add a half gill of liquid shellac and then enough wood alcohol to fill the bottle. Shake it well. It can be made light or dark by using more or less alcohol.

The Reed Organ

The same general principles for tuning the piano are used in tuning the organ. All octaves are tuned perfect.

The fifths and fourths are tuned somewhat flatter than perfect, or three beats in five seconds. It is well for the beginner to hold a watch in the hand so as to be sure of the length of the beats.

Tune the melodia and diapason first. Afterward tune the other stops in accordance.

Organs are tuned by filing or scraping the point or heel of the tongue of the reed. File the point to raise the pitch and scrape the heel to lower the pitch. Sometimes a note is so for out of tune as to make it difficult to determine whether it is sharp or flat. A good way to be sure of it is to strike the two notes together and allow the note to be tuned to come up slowly. If the vibrations become slower, it is sharp. If they become faster, it is flat. This is an infallible rule.

Dirt in Reed.

If a note fails to speak when a key is pressed down, it is usually because there is dust in the reed which prevents the tongue from vibrating. Draw the reed out with the reed hook. A groove will be found in the heel of the reed. Be careful to see that the hook catches firmly in this groove. If the hook is put in too far, it may catch on the tongue of the reed and break it. After the reed is drawn out, brush it off, always brushing from the heel to the point. Sometimes it is necessary to give the reed a slight rap to release the dirt.

Reeds Rattle.

Sometimes the reed cells swell from dampness, thus pressing against the sides of the reed until the tongue strikes against the reed block, causing it to rattle. Remedy: With a small file make the reed frame a trifle smaller and, if necessary, cut enough of the inside of the frame away to allow the tongue to vibrate freely.

Reeds Loose in Cells.

If the reeds are too loose in the cells, take them out and put a thicker strip of felt along the edge. This will hold the reed firm.

Broken Reeds.

If the tongue of a reed is broken, take it out and send to the manufacturer. The octave nearest the centre must be sent at the same time so as to insure its being correctly tuned.

Keys Stick.

Keys stick much from the same cause as in the piano. If the push-down pin sticks, sandpaper it and then black lead it. Should a note sound all the time, it is because dirt is under the valve, or the valve has been pushed too far down and has caught on the guide pins, or the spring may be weak.

A valve can frequently be put in place without taking the chest off. Take a hat pin and put down the push-pin hole. Then work the valve to each side until it finally slips into position. If the valve is entirely off, or dust will not release, or the spring is too weak, the organ must be taken apart to make complete repairs. Sometimes by inserting a wire in the reed socket after the reed is taken out, a valve can be put in position.

Exhauster Valves.

Sometimes after a pedal has been pressed down it fails to come up readily or works lazily. This is caused by the long strips of sheep skin, used as valves, getting loose or curled so as not to fit tight over the holes, allowing the air to escape through the holes. Remedy: Take out the tacks holding it. Rub well so as to soften it and replace. Of course, it is always better to put on new sheep skin if it can be procured.

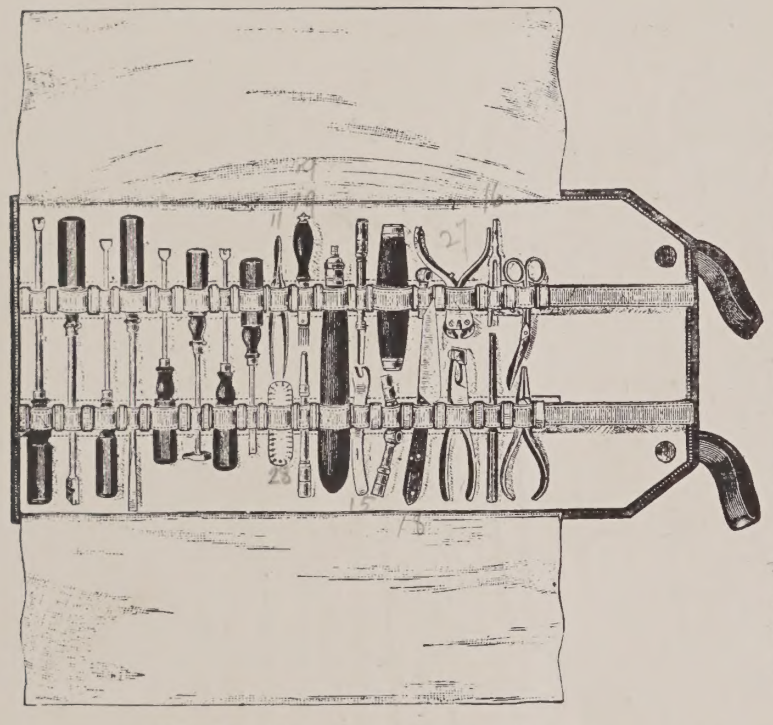
Pedal Straps.

Pedal straps frequently break. Sometimes it is necessary to take the organ entirely apart to replace them. If the panel in the front of the organ can be taken out, it is an easy matter to put on new straps. It is better to have a short handle screw driver made especially fot the purpose. Make the new straps exactly the same length, so the pedals will be even.

To Polish Case.

Wash clean with a sponge, using soap and water, if very dirty. Wipe dry with cheese cloth. Apply J. W. Pepper's organ polish with a small brush or piece of cheese cloth and polish with a clean piece of cheese cloth.

TUNER'S KIT, No. 1.

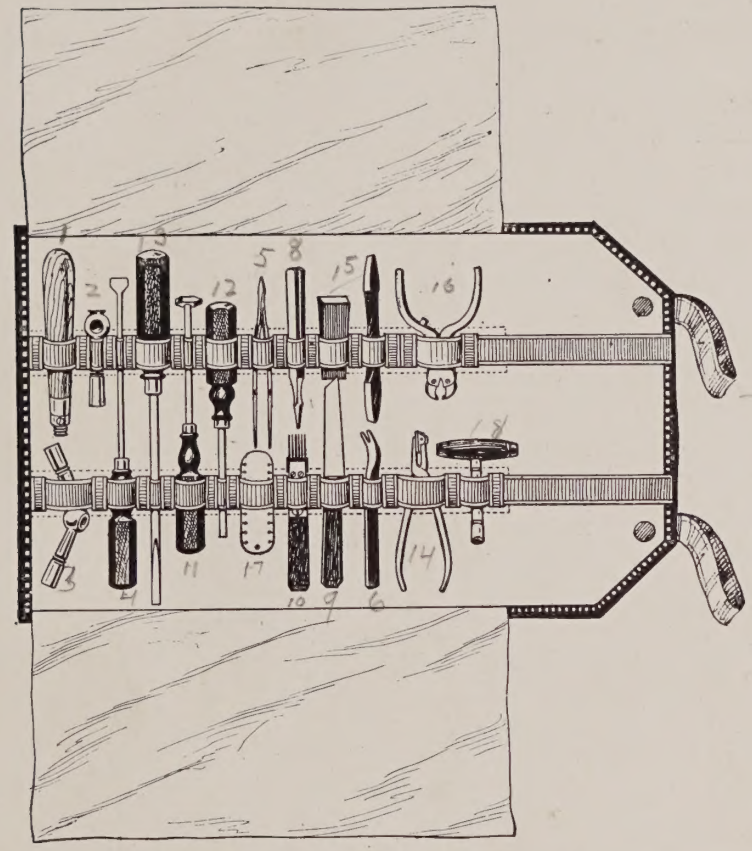


This Kit contains 32 pieces, including Roll, $38.50.

KIT CONTAINS THE FOLLOWING TOOLS:

1 One Extension Tuning Hammer, Rosewood Handle, with Double Oblong Head.
2 One Socket T Hammer Handle, with Square Tube.
3 One Oblong Tube.
4 One Star Head.
One Tube to Extract Broken Tuning Pins.
6 One Action Regulator.
One Regulating Screw Driver, 4½ inches.
8 One Regulating Screw Driver, 6½ inches.
One Key Spacer.
10 One Straight Back Check Spacer.
11 One Pincette, 6 inch.
12 One Spring for Glueing Ivory.
One Damper Scissor.
14 One Morocco Leather Roll.
15 One String Lifter.
16 One A Tuning Fork.
One C Tuning Fork.
18 One Felt Knife.
19 One Pocket Felt Picker.
20 One Double Head Screw Driver.
One Screw Driver, 4 inch.
22 One Screw Driver, 7 inch.
One Key Plyer.
24 One Pocket Glue Pot.
One Upright Tuner's Wedge.
26 One Tuner's Rubber Wedge.
27 One Cutting Nipper, 5 inch.
28 One Music Wire Gauge
One Flat Plyer, 5½ inches.
30 One Small Plane.
Including Flexible Case.

TUNER'S KIT, No. 2



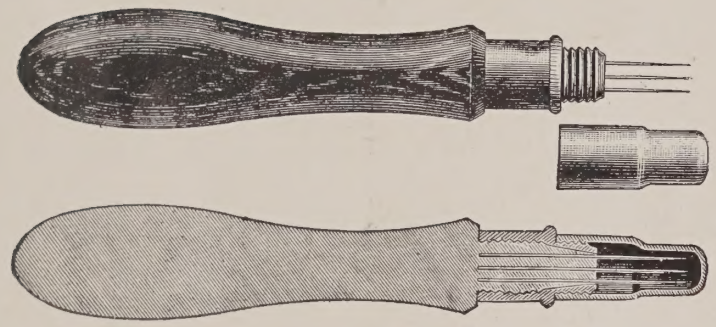
This Kit contains, 18 pieces, including Roll $18.75.

KIT CONTAINS THE FOLLOWING TOOLS:

1 One Tuning Hammer.
2 One Star Head.
3 One Oblong Head.
4 One Regulating Screw Driver.
5 One Pincette.
6 One String Lifter.
7 One A Tuning Fork, International Pitch.
8 One C Tuning Fork, " "
9 One Felt Knife.
10 One Felt Picker.
11 One Double Head Screw Driver.
12 One Screw Driver, 4 inch.
13 One Screw Driver, 7 inch.
14 One Key Plyer.
15 Tuning Wedges.
16 Wire Cutters.
17 One Wire Gauge.
18 One T Hammer.
Including Flexible Case.

Tools

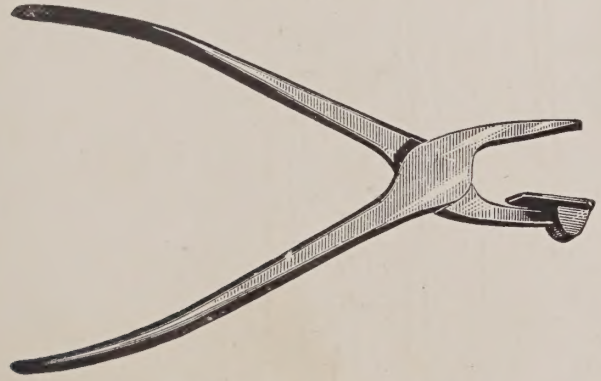
Pocket Felt Pickers.



Used to pick felt hammers which have become hard from use.

With needle box in handle, ... Each, $1.35

Key Plyers.

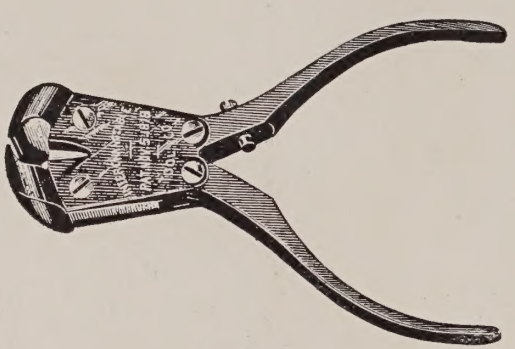


Used to enlarge mortise in keys.

Forged steel, 6¼ inches long, ... Each, $1.35

Hall's Patent Cutting Nippers.

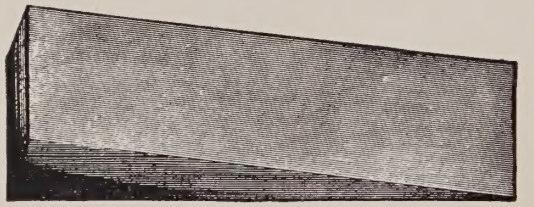
FOR MUSIC WIRE.



Black, ... Each, $1.50
Extra Jaws, ... Per Pair, .50

Tuner's Wedges.

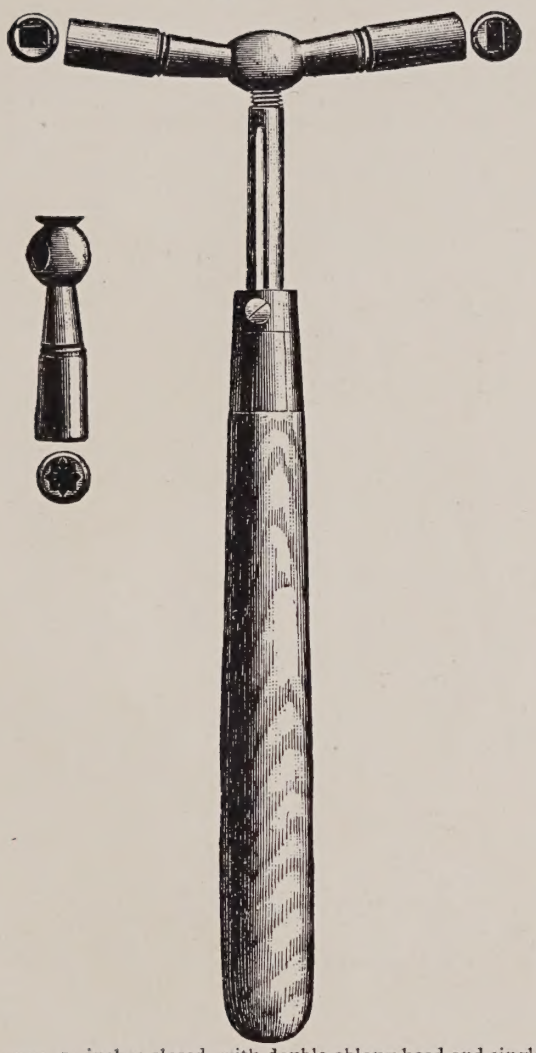
RUBBER.



Each, ... $ .15

Tuning Hammers.

ROSEWOOD HANDLE WITH EXTENSION ROD.



14½ inches open, 10 inches closed, with double oblong head and single star head, ... Each, $6.50

Stringing Hammers.

With stationary handle and bar with oblong or square head, . . Each, $2.15

Wire Gauges.

FOR MUSIC WIRE.

Each, ... $2.15

Screw Drivers.

WITH HANDLES.

¼ inch shank.

Length, 7 inches, ... Each, $ .60

$\frac{3}{16}$ inch shank.

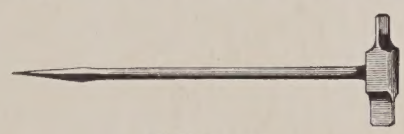
Length, 4 inches, ... Each, $ .40

Regulating Screw Driver.

This tool is used to raise or lower the regulating buttons.

Length, 6½ inches, ... Each, $ .55

Double Head Screw Drivers.



Half size cut.

Each, ... $ .55

String Lifters.

Half size cut.

This tool is used in putting on new strings, to raise the wire at the pin, . $ .35

Tuning Forks.

"INTERNATIONAL PITCH" STAMPED ON EACH FORK.

Made by Valentine & Carr, Sheffield, England.

Guaranteed.

A 435. C 517^3 Vibrations.

Adopted by the Piano Manufacturers' Association as American Standard.

Steel blued, 4⅛ inch, with box, ... Each, $ .80

Pincette, or Tweezers.

Length, 6 inches, ... Each, $ .55

Tuner's Upright Wedges.

BUSHED WITH BUCKSKIN.

8½ inches, ... Each, $ .35

Felt Knife.

One-third size cut.

This knife is used for trimming felts.

Each, ... $ .85

INDEX

A Deep Bruise . . . 51
A Forks . . . 47
A Slight Scratch or Bruise . . . 51
Actions Rattle . . . 27
Actions Work Sluggish . . . 26
Another System for Setting the Temperament . . . 39
Back Catch . . . 8
Back Catches . . . 25
Bass Bridges . . . 51
Bass Strings—How to Order . . . 30
Bridle Ribbons . . . 27
Broken or Cracked Bridges . . . 34
Broken Reeds . . . 52
C Forks . . . 47
Caring for the Piano . . . 51
Celluloid . . . 9
Centre Pins—How to Put in . . . 28
Checking of Varnish . . . 51
Cracked Iron Frames . . . 49
Cracked Sounding Boards . . . 49
Damper Action . . . 8
Damper Rollers Squeak . . . 27
Damper Spoons . . . 25
Defective Damping . . . 9
Defects in Pedal and Trap Action . . . 9
Defects of an Upright Action—Dampers Squeak . . . 26
Depth of Touch . . . 5
Depth of Touch . . . 25
Description of the Square Piano Action . . . 5
Dirt in Reed . . . 52
Ear for Music . . . 35
Exhauster Valves . . . 53
First String in Over Strung Bass . . . 29
Guide Pin . . . 14
Hammers Block . . . 9
Hammers Block in Upright Pianos . . . 29
Hammers Click or Rattle . . . 27
Hammers Stick . . . 7
How to Put in New Bushing . . . 28
Injuries Caused by Mice . . . 30
Introduction . . . 3
Ivories - How to Keep White . . . 8
Jack . . . 6
Jacks Squeak . . . 27
Key Rocker . . . 6
Keys Rattle . . . 6
Keys Stick . . . 52
Loose Pivot Pins . . . 29
Loose Regulating Rails . . . 29
Loose Tuning Pins . . . 29
Lost Motion . . . 14
Mahogany Stain . . . 51
Metal Flange Loose on Hammer Heel . . . 29
Pedal Straps . . . 53
Pedals Squeak . . . 26
Pitch of Old Pianos . . . 30
Rattle in Square Piano . . . 8
Re-capping Hammers . . . 8
Reeds Loose in Cells . . . 52
Reeds Rattle . . . 52
Regulating Screw . . . 7
Removing Broken Tuning Pins . . . 30
Replacing Felt on Key Rails . . . 5
Replacing Hammers . . . 7
Replacing Parts of Action . . . 26
Re-stringing Pianos . . . 30
Revoicing Old Hammers . . . 7
Revoicing Old Hammers . . . 25
Setting the Temperament . . . 37
Standard Pitch . . . 40
Sticking Keys . . . 6
System for Lowering of Pitch . . . 39
Temperament . . . 38
The Grand Piano . . . 35
The Reed Organ . . . 52
To Even Up Hammers . . . 14
To Even Up Keys . . . 14
To Polish Case . . . 53
To Put On New Hammers . . . 25
To Regulate Upright Action . . . 14
To Replace Broken Hammer Stems . . . 28
To Replace Broken Strings . . . 9
To Replace Ivories and Celluloid . . . 28
To Whiten Ivories . . . 9
Travel of Hammers . . . 25
Upright Piano . . . 14
Varnishing Piano Case . . . 48
Why Pianos Get Out of Tune . . . 48

ILLUSTRATIONS

Action released—ready to lift out 15
Clamp for glueing on bridges 34
Correct and incorrect method of stringing a piano 33
Cracked Sounding Board shown from the front 50
Grand Piano Action 36
Hammer butt with tape attached 28
Ivory Clamps 29
Key and Key Bed 5
Part of Roller Lever with socket 27
Position of hand in lowering pitch, using felt wedges, tuning middle string first 41
Position of hand in raising pitch 31
Position when lowering pitch, using stick wedge, tuning left hand string first . 43
Regulating travel of hammer with regulating screw driver 19
Showing how to get depth of touch 17
Spacing hammers, when a wooden flange is used 21
Square Piano Action 4
Tightening action screws 23
Tools 56–58
Tuner's Kits 54, 55
Upright Piano Action 10–13
Where to put kerosene oil when Hammers work sluggish 27
Where to put kerosene oil when Jack works sluggish 26
Where to put screws in ribs when put in from the back 50